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RELATION OF DEPRECIATION ALLOWANCE TO INTEREST ON INVESTMENT.

While the necessity for a proper consideration of depreciation in determining costs and in properly handling the accounts of any business has always existed, it has received much more attention of late years, especially among public utilities since they have been subjected to the regulatory powers of state commissions. The subject is not merely one of proper business accounting, but is of fundamental concern in the problem of determining rates. It enters here both as an element of the cost of running the business and in its relation to the determination of the valuation of the property upon which interest charges are to be figured.

There is wide disagreement among different authorities not only as to the proper amounts to be allowed for depreciation—that is to say, the rate at which equipment loses value—but also as to the method by which this loss should be made up in order that the original outlay shall not be impaired at the end of the useful life of the equipment. We wish here to contrast merely two of the most common methods of making allowance for depreciation. One of these consists in dividing the total amount involved by the number of years representing the known or estimated life of the equipment, and setting aside anually the resulting quotients. The other method is that of setting aside annually such an amount in a sinking fund, that when invested and yielding compound interest at the market rate, the total sum at the end of the same life period will equal the invested capital which has disappeared. It is evident that the annual installments in these two cases are different, and, consequently, will produce different totals for the cost of running the business. We will refer to the two as the straight-line method and the sinking-fund method.

With the straight-line method the capital account should be reduced each year by the amount of the allowance for depreciation. Since this amount is made for other purposes, or might even be withdrawn from the business, interest should not be figured upon it as a part of the original capital, but only in case of reinvestment in other equipment, which would then carry its own interest charge. In the sinking-fund method the earnings of this money, which is presumed to be invested in some way, covers a part of the total depreciation cost and does not earn any interest which may be regarded as taking

care of the fixed charge upon that portion of the original investment. The capital account should, therefore, be retained intact and a yearly return upon it computed upon the basis of the original investment.

The distinction of the difference in status of both capital and depreciation accounts in these two cases is frequently overlooked and as a result two errors commonly arise. One of these is to use the straight-line method for figuring the amount to be set aside for depreciation and to continue to charge interest upon the original capital investment. An example of this is seen in the article on page 823 entitled, "How Many Contractors Lose Money," where interest upon the total cost of an automobile is included, although a straight-line allowance for depreciation is made.

A realization of this relation has given rise to one of the common methods of determining the present value of an investment, namely, by subtracting from the reproduction value the amount of accrued depreciation.

The other error is to use the sinking-fund method in making allowances for depreciation and then, without realizing the fundamental distinction between this and the former method, to similarly deduct the accrued depreciation from the capital account or from a valuation for rate-making purposes. The latter is an injustice to the investors in a utility property, since the entire capital representing original or reproduction cost is still tied up in the business, and the amount representing accrued depreciation is not earning separate interest, but must form a part of the depreciation fund.

It was pointed out above that the annual allowance for depreciation will depend upon the method used. This forms one element in rate-making. Unless a corresponding distinction is made in the capital account upon which fixed charges must be figured, it is evident that a different result must be reached as to the proper value for a rate. This of itself is sufficient evidence that a distinction should be made in figuring fixed charges in the two cases, since two methods can both be correct only when they give the same results.

THE BUREAU OF STANDARDS.

Since its inception nearly 13 years ago the work of the Bureau of Standards has gradually been increasing in both scope and quantity, until today it probably ranks foremost among the national standardizing laboratories of the world with respect to number of employees, amount of annual expenditure, and output as measured in tests carried on, research work and investigations undertaken, as also in scientific and technical material published. The equipment of the Bureau has been steadily increased and this year we see placed in service a new laboratory to be devoted exclusively to electrical and allied work. A description of the new laboratory will be found elsewhere in this issue. In recognition of its completion, the American Institute of Electrical Engineers and the American Physical Society are holding a joint meeting at the Bureau this week, and at the same time there has been arranged an exhibit of physical apparatus, which might well be made an annual event and would, no doubt, take its place with the similar exhibits held each year in London and Paris, in giving publicity to the latest developments in this field.

The importance of the work of the Bureau of Standards in connection with the maintenance of electrical units, of the investigations which have been carried on there, and of the facilities which it offers for the assistance of manufacturers and others in working out the problems which arise in electrical engineering, are widely appreciated, and the liberal policy which has been shown by Congress heretofore in making provision for the work will, it is to be hoped, be continued in the future. The experience of Germany is ample demonstration of the usefulness of such an institution in building up the industry of the nation and examples of its similar effect here are becoming evident and are frequently attested by our manufacturers. The increased facilities which will be provided by the new laboratory should still further enhance the worth of the work done by this section of the Bureau and render it of ever growing importance and value to the electrical industry.

FLEXIBILITY IN RESIDENCE LIGHTING.

Nothing popularizes electric service more than its flexibility, provided reasonable rates are offered the public. This is peculiarly true in the house-lighting field, and the selection of different lamp sizes for various rooms is an all but universal practice. Less has been made, however, of the opportunity afforded by the subdivision of lamp sizes within a single room to give the consumer a service of the maximum convenience and which at the same time encourages long-hour burning.

An example may be cited in a six-room apartment whose small parlor, perhaps 12 feet square, was equipped with a chandelier in the center of the room having three outlets. The old-time plan would have been to provide the same sized lamp for each outlet; but in this case three sizes were put in, and with admirable results. The outlet nearest the inside wall, and consequently nearest the piano, was fitted with a 40-watt tungsten lamp; that nearest the hallway door was provided with a 10-watt lamp, and a 25-watt lamp was installed in the intermediate outlet. The largest lamp provides a first-class illumination for musical purposes; the intermediate size suffices for conversation with callers, and the 10-watt lamp serves as a "pilot light" and is kept burning nearly all of every evening, whether the room is in use or not, partly to let passers-by know that the family is in town and partly to provide a cheerful atmosphere at the front of the house.

If a 25-watt lamp or larger were used in each outlet, the service would be turned off every time the

room was vacated, but the cost of service with the 10-watt lamp is so small on a 10-cent per kilowatt-hour rate that it is seldom turned off, even if the family is away for the evening. There is not the slightest doubt that the local central station obtains more revenue from the subdivided lamps in this room than from a uniform installation, and while there is nothing remarkable about so simple a subdivision, it is worth studying in hundreds of installations which in the past have been equipped with orthodox uniform sizes for similar rooms.

A REFERENDUM ON THE INTERSTATE TRADE COMMISSION.

The Bill recently reported into the House of Representatives by the Committee on Interstate and Foreign Commerce, relative to the proposed Interstate Trade Commission, is being made the subject of a referendum before the 543 commercial organizations in 47 states, constituent members of the Chamber of Commerce of the United States of America. Shortly after the annual meeting of the National Chamber, which was held in February, a special committee was appointed to ascertain the significance of the proposed legislation affecting corporations. This committee has completed its report and the Chamber is now asking the business men of the country to study the proposed features of the Bill and to vote one way or the other upon certain definite recommendations.

The committee recommends that an interstate trade commission of at least five members be appointed. It is considered that a commission composed of three members would not be general enough in character, would lend itself to domination by one particularly strong character, and would not allow of the widest latitude in the selection of the personnel. It is also proposed that not more than a mere majority of the members of the commission shall be of the same political party. It is recommended that the jurisdiction of the commission in conducting an investigation, extend to all corporations engaged in either state or foreign commerce, except such as are amenable to the Interstate Commerce Commission. The committee recommends that the commission should not be given authority at this time to advise applicants concerning the legality of proposed contracts, combinations and other business exigencies under the Sherman Act. It is the opinion of a majority of the committee that extending the jurisdiction of the commission to this extent would bring about an interminable delay in the conduct of business of every character, and would lead to indecision and indefiniteness that would work harm.

With respect to what might be disclosed in the annual reports the committee strongly recommends that corporations ought not be required to disclose their processes, shop costs, classifications of sales and profits among particular articles, names of customers, or similar kinds of private information. In other words, if investigation be necessary for the protection of the public and for prescribing means for the safe conduct of business it should be along lines which will not reveal those factors which courage, initiative and aggressiveness develop. The function of government should never be to expose to those unable to think and work for themselves that which intelligence and daring bring to the advantage of those of higher mental and physical equipment.

So far as the publication of facts obtained by the commission is concerned, the committee recommends that this be confined to such matters as are to the public interest. Foreign relations and expanded opportunities for doing a foreign business are considered in the recommendation that Congress should direct the commission to investigate and report to Congress at the earliest practicable date on the advisability of amending the Sherman Act to allow a greater degree of co-operation in the conduct and for the protection of the foreign trade. With respect to the latter recommendation it is made clear that home industries are at present under severe handicap in foreign markets.

A large number of organizations, constituent members of the National Chamber, have already appointed committees to pass upon this referendum, and it is expected that the votes will be promptly returned. An analysis of the expressions of opinion coincident with the vote on the referendum will help materially to create at least a reasonable approach to, first, the necessity, if it exists, for the development of the Interstate Trade Commission, and second, an indication of those features which should form the basis of the Bill creating the commission.

ALLOWANCE FOR OVERHEAD EXPENSE.

The necessity in any business of making the proper allowance for overhead expense when determining the prices to be charged is a fundamental one, but unless this situation is properly understood and handled, the concern which is negligent is likely sooner or later to go to the wall. Deficiencies along this line have been common in the electrical contracting business and the various contractors' associations have been doing an important work in educating their members to the necessity of properly handling this element of the business.

There is nothing, perhaps, so impressive in teaching a lesson as a concrete example, which is based upon the principle involved. Having this in mind a California supply house has been distributing among the electrical contractors of that territory a definite monthly statement for two typical contracting businesses, showing how a proper allowance for overhead in one case results in a net profit and an insufficient allowance in the other case results in a net loss. A study of these figures should be of value to any contractor who has not already placed his business upon a sound basis.

International Electrical Congress.

Arrangements are being perfected for the International Electrical Congress to be held during the Panama-Pacific International Exposition in San Francisco during the week beginning September 13, 1915. Charles P. Steinmetz is honorary president of the Congress and Edward B. Rosa is honorary secretary. This congress will be the eleventh electrical congress of international scope, three of which have been previously held in the United States.

The meetings of the congress will be divided into 12 sections and the proceedings will be published in 13 volumes, one for each of the sections and one containing the general proceedings of the congress. These sections are as follows: 1. Generation, Transmission and Distribution. 2. Apparatus Design. 3. Electric Traction and Transportation. 4. Electric Power for Industrial and Domestic Use. 5. Lighting and Illumination. 6. Protective Devices; Transients. 7. Electrochemistry and Electrometallurgy. 8. Telegraphy and Telephony. 9. Electrical Instruments and Electrical Measurements. 10. Central-Station Economics. 11. Electrophysics. 12. Miscellaneous Subjects.

It is the desire of the committee making arrangements to secure as early as possible some idea of the number of persons who wish to be enrolled as members of the congress, in order that some definite figures may be available respecting the number of copies of the transactions of the congress that are to be published, and also so as to know approximately what funds will be available for meeting the expenditures. The published transactions will contain all of the papers accepted for presentation; these papers will be printed in English, French, German, Spanish and Italian as they are received; all papers printed in languages other than English will be accompanied by English abstracts.

The membership fee in the Congress is $5, which entitles a member to the privileges of the congress, to the general index and to a choice of any four of the section volumes of its printed transactions. By the payment of $1 the volume ordered will be delivered to the member without further expense, and by the additional payment of 50 cents per volume they will be bound in cloth. Additional volumes may be had at $1 each when bound in paper and $1.50 each when bound in cloth. The entire set, which will comprise probably 13 volumes, will be delivered for $11, if bound in paper, or for $16, if bound in cloth; the latter fees include membership in the congress. All those wishing to be identified with the congress should early notify the secretary-treasurer, Preston S. Millar, Eightieth Street and East End Avenue, New York City. Remittances for the fees should accompany the applications.

Municipal Hydroelectric Plant Development Condemned at Springfield, Mass.

Prof. Harry E. Clifford of Harvard University, consulting engineer in street lighting for the city of Springfield, Mass., stated in an interview recently that the development of a hydroelectric plant by the city for municipal lighting in connection with the Little River watershed would be a serious mistake. He urged the municipality to make the best terms possible with the United Electric Light Company in renewing its street lighting contract and also condemned the proposition that the city establish isolated plant service for the lighting and power requirements of the new municipal building group. Professor Clifford said that municipal ownership is a will-o'-the-wisp on account of its labor and political possibilities and pointed out that even if the city should develop a hydroelectric plant on the Little River watershed, there would be a loss of 15 to 18 per cent in the electrical transmission of 14 miles involved and that the cost of a duplicate system of underground ducts to compete with those of the existing central station would hit the taxpayers to the extent of about $3,000,000. Regarding the proposed isolated plant scheme for the municipal group, Professor Clifford said that the bids presented by various manufacturers of generating equipment are unduly low for the requirements and he pointed out that no auxiliary machinery is provided in the tenders and that the present boiler installation could not be expected to meet the demands of the power and lighting service.

Chicago Electric Vehicle Men to Meet at Jovian League Luncheons.

At the luncheon of the Chicago Section, Electric Vehicle Association of America, on Tuesday, April 21, in the Rose Room, Hotel Sherman, it was decided to discontinue the weekly luncheons of the section, substituting therefor monthly meetings in the evening and Vehicle-Association tables at the luncheons of the Chicago Jovian League at Hotel Sherman every Monday noon. This change was made in order to reduce the number of luncheons that many attend each week.

W. H. Metcalf, of the Philadelphia, Pa., section, told of the activities in that section. Monthly meetings are held at which many owners of cars are present. It is the aim of the Philadelphia section to obtain a good representation from car owners, and thus far their efforts have been very successful. About 640 electric trucks are now in use in Philadelphia.

New Officers for Institution of Electrical Engineers.

J. F. C. Snell has been nominated for president of the Institution of Electrical Engineers, to succeed William Duddell, who shortly closes his second year in the chair. Mr. Snell is pre-eminently an electric supply authority. For years he stood high in the councils of the municipal electrical officials as city electrical engineer and manager at Sunderland. He went to London when the London County Council was beginning to interest itself several years ago in the question of a comprehensive scheme for the future supply of the whole London district. He is a partner in the consulting engineering house founded by the late Sir William Preece—Preece, Cardew & Snell.

The new vice-president will be J. S. Highfield, also a leader in the electric supply field, and C. H. Wordingham, electrical engineer to the British Admiralty.

Meeting of Society for Electrical Development.

The Society for Electrical Development announces that its annual meeting will be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., on Monday, June 1, at 10:00 a. m. The object of calling this meeting at this time is to enable those who are attending the National Electric Light Association's convention to also attend the annual meeting of the Society. At the annual meeting of the Society, new directors will be elected. Immediately following that meeting the annual meeting of the board of directors will be held for the purpose of electing officers for the coming year.

The Pageant and Masque of St. Louis.

A huge pageant and masque will be staged near Art Hill, St. Louis, Mo., from May 28 to 30 inclusive, to celebrate the 150th anniversary of the founding of the city. The pageant will reproduce the romantic history of St. Louis from the time of the mound builders to the celebration at the close of the Civil War. This will be followed by a masque in two parts, symbolic of the history of St. Louis. About 7,500 persons will be included in the cast and many unique electrical features will aid in making the celebration a success.

Chicago Jovian League.

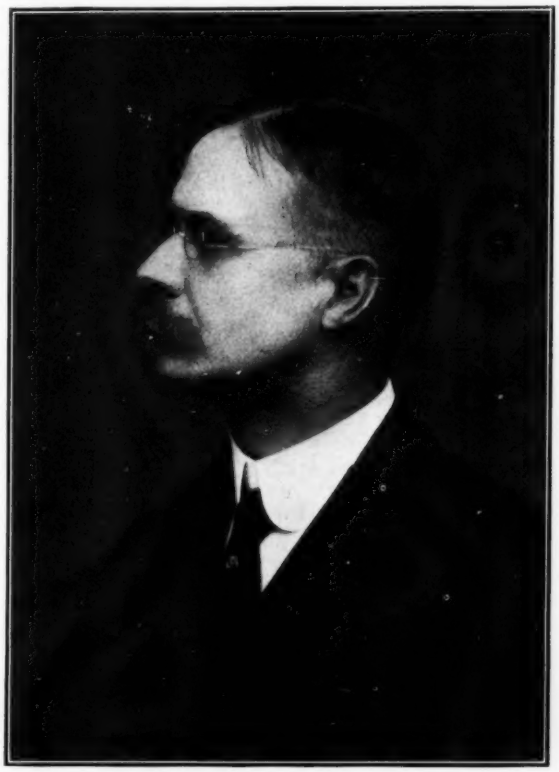
At the meeting of the Jovian League of Chicago, on April 20, F. P. Wilbur, superintendent of telegraph, Illinois Central Railroad, delivered a very interesting address on the subject of "Telephone Train Dispatching." Elbert Hubbard also delivered an amusing talk.

Edward B. Rosa.

One of the important elements in any industry is the establishment of suitable standards of measurement. In this country the Federal Government has sole power through Congress to fix all standards of weights and measures. In the case of the electrical units, Congress adopted the definitions which were laid down by the International Electrical Congress meeting at Chicago in 1893. For many years there existed in the Coast and Geodetic Survey an Office of Weights and Measures which had custody of the fundamental standards for measurements involving length and mass. When the necessity finally arose, this bureau also instituted work along the line of maintaining standards for electrical measurements as well as a few standards in other fields. It was not, however, until 1901 that Congress created the Bureau of Standards to take over the functions of the previous Office of Weights and Measures, and at the same time enlarged these functions so as to place in operation a national standardizing laboratory.

As director of this newly created Bureau of Standards there was appointed Samuel W. Stratton, who still continues in that office. In organizing the work of the Bureau, Dr. Stratton sought a man to place at the head of its electrical work who would combine a sound knowledge of mathematical and experimental physics with a familiarity of the problems and requirements of electrical engineering and the electrical industry. His choice fell upon Edward B. Rosa, who was called to Washington in 1901 to take charge of this work. His title at that time was physicist, but has since been changed to chief physicist, and his rank is next to that of the director of the Bureau. Under Dr. Rosa's direction the electrical work of the Bureau has been extensively developed and has already achieved much, both from the point of view of electrical standards and in the solving of problems connected with practical electrical work.

From the first it was the idea of its founders to provide a separate building for the electrical work, but the accomplishment of this was a matter of time. When the Bureau of Standards first moved to its present location on Pierce Mill Road in the District of Columbia, its housing consisted of a physical laboratory and a mechanical laboratory. To these were afterwards added a cryogenic laboratory and a building to house the sections dealing with heat and with engineering measurements. About three years ago an appropriation was made by Congress for building a separate electrical laboratory and the building itself was completed nearly a year ago. It has taken some time, however, to properly equip it and it is not until the present week that it has been thrown open to public inspection, in connection with the meeting held there by the American Institute of Electrical Engineers and the American Physical Society, conjointly. A description of the new laboratory will be found elsewhere in this issue. Its work will be directed by Dr. Rosa.



Edward B. Rosa,
Chief Physicist, Bureau of Standards.

Edward Bennett Rosa was born in Rogersville, N. Y., on October 4, 1861, the son of Edward David and Sarah G. (Rowland) Rosa. He attended Wesleyan University, being awarded a bachelor's degree in 1886. He later went to Johns Hopkins University, taking the degree of Ph. D. in 1891. In 1906 Wesleyan conferred upon him the honorary degree of Doctor of Science. After spending a year as instructor in physics at the University of Wisconsin, Dr. Rosa was made associate professor of the same subject at Wesleyan University, and afterwards professor. He remained here in this capacity until 1902. Among his early work was a determination of the ratio existing between the electrostatic and electromagnetic units; the investigation of the wave form of alternating currents, for which purpose he devised a curve tracer; and the measurement of the dielectric constants of electrolytes and the dielectric losses in condensers. In connection with the physiological investigations of F. G. Benedict he designed a respiration calorimeter.

Since taking up his work at the Bureau, Dr. Rosa's attention has been largely devoted to absolute measurements of electrical quantities. In conjunction with his assistants he has made a new determination of the ratio of the electrical units; has determined the electrochemical equivalent of silver in absolute measure by means of the current balance; has discovered the cause of former discrepancies in measurements of this constant; has devised methods for the measurement of capacity and inductance and worked out formulas for the computation of the self and mutual inductances of coils from their linear measurements. The photometric work of the Bureau has also been under his direction and he has given considerable attention to the problems involved in this work.

Dr. Rosa is a Fellow of the American Institute of Electrical Engineers and of the American Association for the Advancement of Science. He is a member of the American Physical Society, the Illuminating Engineering Society, the Société Francaise de Physique, the Washington Academy of Sciences and the Washington Philosophical Society. He has served as vice-president and as secretary of Section B of the American Association and as president of the Washington Philosophical Society. He has taken a prominent part in the international negotiations for determining specifications for the electrical units and for the international candle. He is a member of the International Electrotechnical Commission and has been made Honorary Secretary of the International Electrical Congress to be held in San Francisco next year. He is

now serving upon the Standards Committee of the American Institute of Electrical Engineers and upon the Committee on Nomenclature and Standards of the Illuminating Engineering Society.

Dr. Rosa is a member of the Cosmos Club in Washington and makes his home in a beautiful suburb of Washington known as Cleveland Park.

Toledo Jovians Hold Big Rally.

On Friday evening, April 17, Toledo Jovians, under the leadership of Statesman Charles Felker, held an imposing rally in Zenobia Hall, Toledo, O., between 300 and 400 Jovians being in attendance. The "get-together" co-operative spirit was never better exemplified than in the ready response and marked enthusiasm that greeted each speaker. Toledo has always been active in Jovianism and it is expected that as a result of this rally a luncheon league will be formed and the work carried forward locally more energetically than ever. The chairman of the entertainment committee and master of ceremonies was Harry Adams, of the W. G. Nagel Electric Company. He introduced Sam A. Hobson, western advertising manager of the *Electrical World*, who made an interesting address on the early days of the Jovian Order, relating the ideals of the founders of the organization, and commented upon the fine way in which the hopes of the pioneers were being more than realized in the progressive spirit engendering harmonious relations between all elements of the electrical industry through the work of the present-day Jovians.

H. H. Cudmore, of the Board of Arbitration of the National Lamp Works of the General Electric Company, made his usual witty address, directing his remarks particularly to the work of the Society for Electrical Development, Incorporated, and what it will mean to the electrical industry.

Mr. Cudmore was followed by A. A. Gray, of Chicago, who spoke of the benefits that the utilization of electrical energy and current-consuming devices was bringing to the community where these services were made available. Mr. Gray emphasized particularly the necessity for the electrical salesman having a very thorough understanding of the materials he was handling and their utilization for every form of domestic and industrial application. He also made the statement that electrical utilities and current-consuming devices were available to the public today at a lower cost than practically any other commodity with which the public is familiar when the advantages ensuing and the cost of producing these advantages were considered. Mr. Gray also pointed out that the community that encouraged the development of the service-rendering public-utility corporation derived far greater advantages than it conferred in the way of profits to the corporation. Incidentally, the record was very plain that where the community had throttled the opportunity of the public-utility corporation and had reduced its facilities through a niggardly and unwise policy of strained economy, that that community had inevitably fallen into a degenerated spirit where industry found it impossible to survive, workers found living conditions hardly tenable and investment was driven, possibly never to return, from its commercial enterprises.

S. E. Doane, chief engineer of the National Electric Lamp Association, pointed out that our greatest civilization was being accomplished largely through our present-day appreciation of scientific advances. He said that the present supremacy of the American people was due to their ready acceptance and utilization of those developments which the protection and promotion of the sciences had made possible. The development of the electrical industry and the utilization of electrical energy and current-consuming devices had done more to enlarge and improve our civilization than any other development of the sciences and arts within the present knowledge of man.

Thomas E. Valentine, president of the Valentine Electric Sign Company, Atlantic City, N. J., the designer of the great slogan sign installed by the Consolidated Railways & Light Company at Toledo, related briefly some Jovian experiences and commented upon the value of the friendships made and the co-operation developed in the carrying on of the business of the electrical industry through the spirit of the Jovian Order.

Homer E. Niesz, secretary of the Budget and Expense Committee of the Commonwealth Edison Company of Chicago, was introduced by Mr. Adams as the candidate for the office of Reigning Jupiter of the Jovian Order. Mr. Niesz made a happy address discussing the opportunities for both social advancement and practical business advantage through the work of the Jovian Order. He outlined the very practical work that was now being accomplished by the commercial division of the Order, and suggested a number of advanced ideas whereby this development may be enlarged.

Henry L. Doherty, president of H. L. Doherty & Company, and chairman of the Board of Directors of the Society for Electrical Development, Incorporated, received an ovation upon being called to the platform. It was some minutes before the tumult of applause made it possible for Mr. Doherty to make a few well-chosen remarks relating to the spirit and enterprise back of the Society for Electrical Development, and in fact back of the men who were responsible for the development of the electrical industry as we know it today. He had no patience, he said, with that attitude of mind that demanded something for nothing, and he said for himself he was convinced that the American people appreciated good service and in the long run would pay for it generously.

Mr. Doherty was followed by E. H. Haughton, general manager of the Bryan-Marsh Division of the National Lamp Works of the General Electric Company, and chairman of the Investing Committee of the National Electric Lamp Association. Mr. Haughton said that statistics show that 90 per cent of the men in this country over 60 years of age either had to work for a living or be dependent upon their families for support. He described the plan of the Nela investing committee where 7,000 employees of the National Electric Lamp Works had invested nearly $1,000,000 in securities in the companies owned or controlled by the Doherty interests, and said that there was being returned to these wage-earners a thoroughly satisfactory dividend upon their savings.

The last speaker of the evening was Elbert Hubbard, the brilliant writer, publisher of the *Phillistine* and the *Fra*, who delivered a remarkable address upon Benjamin Franklin, the original Jovian in spirit.

During the evening several of the speakers make allusions to the street railway controversy which is agitating Toledo at the present time, and concerned with which Mr. Doherty is the central figure. Judging by the tribute of applause evoked by Mr. Doherty's appearance and remarks, the rank and file of electrical men of Toledo are proud to show their confidence in his ability to cope with the situation and are enthusiastic for his success.

Subscriptions to Bulletin of Bureau of Standards.

The scientific and technical papers of the Bureau of Standards are published as separate articles which may be obtained by anyone free upon application. These articles are also collected into issues of the periodical known as the *Bulletin of the Bureau of Standards*, each volume of which contains four numbers. The *Bulletin* is now in its tenth volume. Heretofore it has been sent mainly to libraries, public institutions and such other places as would find complete sets of the papers of value.

Additional arrangements have now been completed by which private individuals may secure complete sets through the payment of a subscription, which has been fixed at $1.00 per volume for the separate issues as they appear, or $1.50 per volume complete, bound in cloth. Subscriptions should be sent to the Superintendent of Documents, Washington, D. C.

The New Electrical Laboratory of the Bureau of Standards.

This article gives a brief general description of the new electrical laboratory of the Bureau of Standards and its equipment. Space does not permit a recital of all the details of this building, but some of the more important features are described and illustrated. Some interesting features of the construction work will be found in another article on page 820.

The electrical work of the Bureau of Standards has recently been moved into a new laboratory building. It is the fifth and largest of the group of buildings housing the work of the Bureau. The Bureau is located on an elevated tract of land in a suburban district of Washington, D. C., well away from other buildings of any kind, and from heavy traffic. Conforming to the general architectural plan of the group, the building is a stone-trimmed brick structure of fireproof construction. It is 64 by 196 feet in ground area and four stories in height, but as the basement is fully finished, there are five full floors, giving a useful floor space of approximately 36,000 square feet, besides an attic giving ample storage space. The cost of the building was $200,000, which figures out to be $5.50 per square foot of useful floor space or 27 cents per cubic foot.

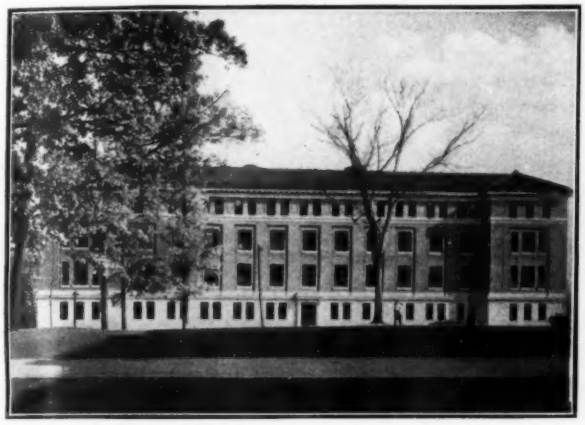


Fig. 1.—The New Laboratory Building.

Fig. 2.—Lecture Room, Showing Method of Lighting.

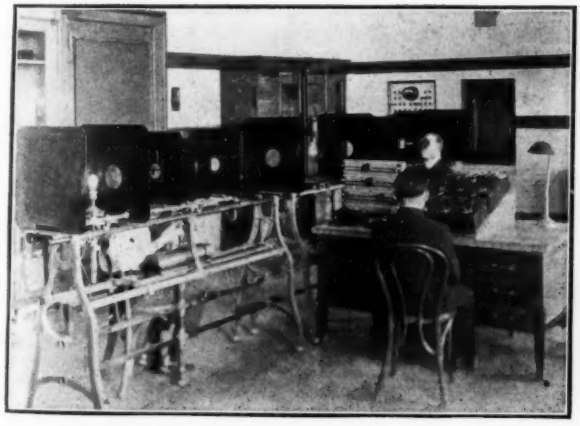


Fig. 3.—Standard Double Photometer, Showing Potentiometers, Automatic Recorder, Lamp Rotator, Sectored Disk, Etc.

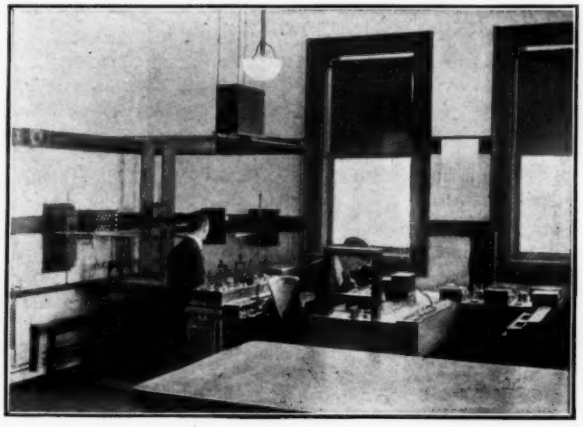


Fig. 4.—Apparatus Set Up for Testing Ammeters, Wattmeters and Watt-hour Meters.

The flooring is of oak, with the exception of a few rooms which have a special composition floor, and the corridors which have terazzo; and there is a wainscot of gray brick.

For the accommodation of scientific and technical meetings of societies and conventions held at the Bureau from time to time, and for periodic meetings of the staff of the Bureau, a lecture room is provided, capable of seating 300 persons.

Lighting.

The lighting is on the semi-indirect system. Contrary to general custom the bowls, which accommodate but a single unit each, are placed at a constant floor height rather than at a constant ceiling distance. Except in special cases requiring more illumination, 60-watt tungsten lamps are used, and the spacing is such as to require about 0.6 watt per square foot of floor area. The average resultant illumination in a horizontal plane 30 inches from the floor is from 2.5 to 2.75 foot-candles on the basis of new lamps.

The lighting of the lecture room of the new laboratory is carried out on a different plan, and is shown in Fig. 2. Light is diffused from 81 square panes of glass arranged in a square in the ceiling. Above each pane of glass is a lamp and a reflector. The resultant illumination is from 4 to 6.5 foot-candles over the seated area, and averages about 4.5 foot-candles over the whole when 40-watt lamps are used. This means an expenditure of about 1.2 watts per square foot, the efficiency being about 4 lumens per watt.

Organization of Work.

It may be well, before describing the equipment of the building, to indicate in a general way the subdivision of the work of the electrical division of the Bureau, especially as some of it is not strictly electrical. In nearly every case the work includes both testing and investigation. The various sections deal with electromotive force; resistance; inductance and capacity; absolute electrical measurements; radiotelegraphy; radioactivity; electrical measuring instruments, meters, and instrument transformers; magnetic measurements; flame photometric standards; electric photometric standards, including inspection and life test; regulations for illuminating gas; high-voltage safety appliances and regulation; electrolysis investigations (street railways); co-operation with public service commissions in standardizing regulations for meters, etc.

General Equipment.

Practically all the laboratories in the building are supplied with alternating and direct current (usually brought to Hubbell outlets placed at convenient intervals), gas, compressed air, and hot and cold water. In addition, steam, vacuum, acetylene, and refrigerating brine pipes are run to some of the laboratories as the special nature of the work requires. Brine coils are brought to four refrigerating closets on each floor, but the cooling coils will be installed only as needed for the particular requirements of the work.

Besides having access to the facilities of the power plant supplying the other buildings, the new laboratory has a dynamo room which at present contains seven motor-generator sets. Two of these are direct-current sets used primarily for charging storage batteries. The other five are alternator sets, there being from two to eight alternators on a single motor shaft, making a total of seventeen alternators, ranging in frequency from 12.5 to 3,000 cycles. Several of these have special features such as phase-shifting devices, arrangements for building up complicated wave forms, etc. In addition there are five smaller motor-generator sets installed in the various laboratories. All the motors driving alternators are usually supplied from storage batteries in order to secure steadiness of operation.

It may be of interest to list the storage-battery equipment, totalling nearly 800 cells. All are lead cells, but several types are represented.

Number of cells.	Ampere-hours.	Purpose.
128	400	Driving motor-generators, etc.
128	200	Driving motor-generators, etc.
64	120	Photometric testing.
64	120	Photometric testing.
15	120	Photometric testing.
60	120	Magneto testing.
45	24	Magneto testing.
15	120	Miscellaneous use.
4	4800	Instrument testing.
4	800	Instrument testing.
4	200	Instrument testing.
240	40	Instrument testing.

This list does not include portable cells for miscellaneous use. Recourse may also be had if necessary to four 130-cell batteries of 200 and 400 ampere-hours capacity, which are located in the power plant.

The distributing system is necessarily somewhat elaborate. Two panels of the main switchboard in the dynamo room are plug panels from which trunk lines lead to ten small panels distributed about the laboratories, each small board serving a small group of rooms, and also to a good sized board supplying the electrical-instrument laboratory.

One of the basement rooms is fitted for shop work with a lathe, drill press, grinder, etc., for the use of the laboratory men. This is in addition to the regular instrument shop of the Bureau, which has a staff of fifteen mechanicians.

Remote Control of Generators.

A motor-operated remote-control system has been installed by means of which the complete control of any of the larger motor-generator sets may be obtained directly in any room where its output is to be used, by merely plugging in a jack for the given machine. Five levers of a small controller then enable one to adjust frequency, current or voltage, phase, and an auxiliary direct-current voltage, to an accuracy of about 0.02 per cent or better over the working range. Fine and coarse adjustments are obtained by operating the motor at two widely different speeds.[1]

Special Equipment.

The nature of the work requires many very special pieces of apparatus and equipment. Only a few of these can be mentioned here.

For the heavy-current testing, four large storage cells already mentioned serve as a direct-current source. Built into the busbar system leading from them is a water-cooled tubular rheostat capable of carrying 10,000 amperes, a special mercury reversing switch, and a heavy electrodynamometer serving as a transfer instrument for alternating current. The rheostat is motor-operated.

For work in absolute electrical measurements of the highest precision special provision is made in one end of the basement. Manganese steel beams are used in the concrete structure in order to minimize magnetic disturbances. There is a special balance room with piers, double walls minimizing the variations of temperature, etc. A dark room is also provided.

Below the sub-basement is a vault for the standard cells which serve for the ultimate standard of electromotive force. The temperature of the room as well as that of the bath in which the cells are kept will be thermostatically controlled. It is probable that the humidity will also have to be controlled.

Three rooms have been very thoroughly equipped as chemical laboratories, one serving as a pure-materials laboratory for the work on the standard cell and the silver coulometer, the

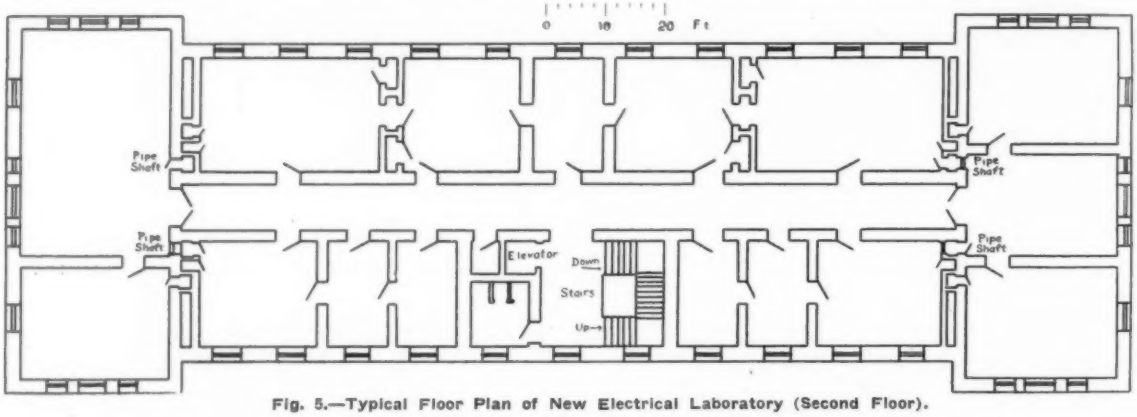


Fig. 5.—Typical Floor Plan of New Electrical Laboratory (Second Floor).

1 This arrangement is described more in detail on page 821 of this issue.

other two rooms being occupied by the work in gas investigations.

Life Test of Incandescent Lamps.

Since the Bureau is charged with the entire technical supervision of the purchase of incandescent lamps for the Government, amounting now to more than a million lamps per year, a very complete equipment for life test has been installed. In an adjacent room is a photometer bench used entirely for the life-test work. A small integrating sphere has been installed to facilitate the study of the variations of the reduction factor, or the ratio of mean spherical to mean horizontal candlepower, during the life of the lamp under test.

Some Laboratory Details.

Instead of heavy fixed tables for laboratory work, heavy maple-top portable tables have been adopted. They are all 31 inches high and 34 inches wide and are of three standard lengths, 72, 60 and 24 inches. This allows arrangement in L's, T's, U's, etc., to suit any particular class of work. The two smaller sizes are used in much larger numbers. A considerable number of special "bench units" 34 by 60 inches are also used. They are much like an ordinary flat-top desk, but have heavy maple tops, and a cupboard in one pedestal.

A 2-by-3-inch bench-rail is attached edgewise to the walls of the room at table height, forming a support for permanent fixtures such as gas, water and air cocks, Hubbell outlets, etc., as can be seen in Fig. 6.

The laboratory wiring is carried around the outside walls of the room in a wooden conduit with removable cover, to provide easy access for changes.

Two dadoes, each about 6 inches wide, are carried around the outside walls at heights of 52 and 80 inches respectively. These are very convenient for mounting galvanometers and other instruments, as may be seen in some of the accompanying illustrations.

The shades at all east, west and south windows are provided with a device for adjusting the whole shade to any desired height. This is a great convenience in adjusting the light for many laboratory purposes. All window frames are so constructed that special dark shades may also be installed with very little trouble. The windows in some rooms, including, of course, the lecture room, have been equipped with these shades.

High-Voltage Laboratory.

A separate small building has been erected for the high-voltage work, and two 5,000-volt, two 25,000-volt, and two 100,000-volt transformers installed, having capacities of 2, 3 and 10 kilowatts respectively. They were installed in pairs for use in the precise determination of the ratio and phase angle of voltage transformers by a standard transformer method. Some insulation testing will also be done with them. The system of distant control has also been extended to this building, allowing a practically continuous adjustment of voltage over wide ranges from the laboratory.

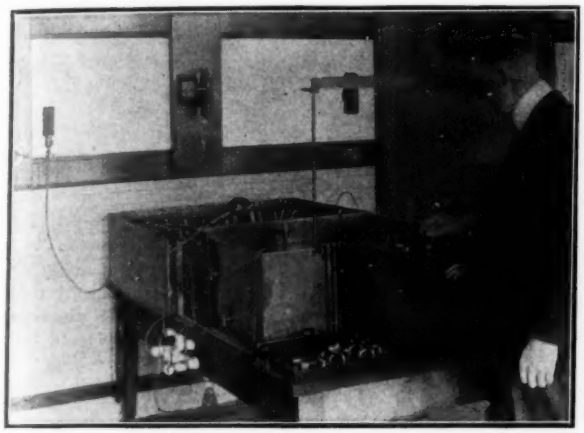


Fig. 6.—Apparatus for Precision Measurement of Resistance Standards. The Temperature of the Bath Is Thermostatically Controlled.

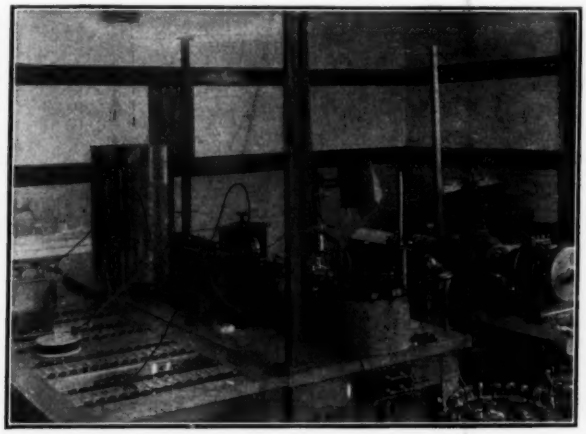


Fig. 7.—Apparatus for Measuring Inductance and Capacity. Standard Condensers at Left are Kept at Constant Temperature and Humidity.

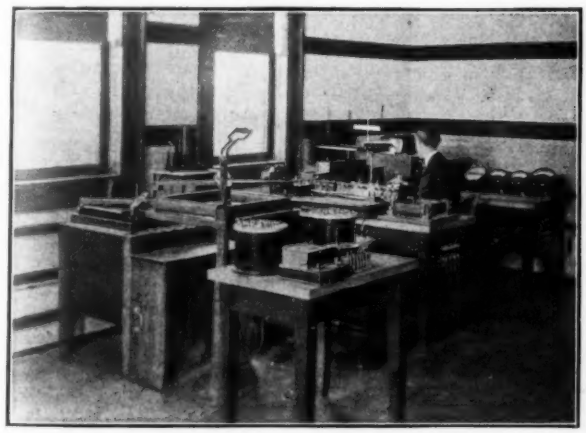


Fig. 8.—Two Modifications of Epstein Apparatus for Testing of Sheet Iron.

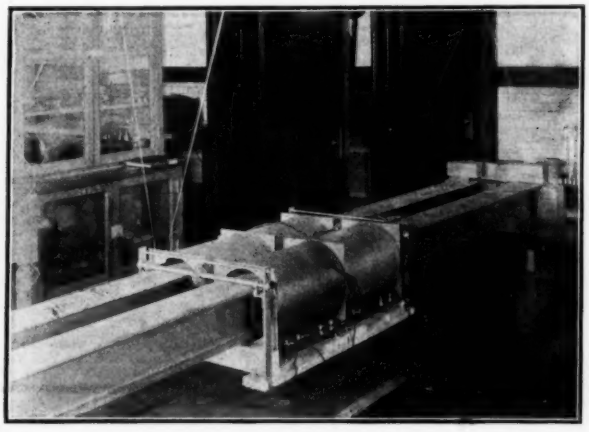


Fig. 9.—Apparatus for Investigating Feasibility of Flaw Detection in Steel Rails Magnetically.

Commercial Practice
Management, Rates, New Business

Convention of Commercial Men of Ohio Central Stations.

Approximately 50 delegates representing new-business departments of Ohio central stations, electrical contractors and manufacturers in the state, convened at the Dayton Club in Dayton, O., on April 15 to interchange ideas on central-station commercial methods. The meeting was the second of its kind held under the auspices of the Committee on New Business Co-operations of the Ohio Electric Light Association. This committee has established a precedent in association work by these meetings, at which the representatives of the small towns are specially invited to participate. The committee under the leadership of Thomas F. Kelly, sales manager of the Dayton Power & Light Company, has made every effort to find out the problems that are confronting the commercial men in the smaller towns and the programs of the two meetings so far held have been prepared with this in view.

The morning session was called to order by Chairman Kelly and Fred Rike, the personal representative of the mayor of Dayton, introduced. Mr. Rike cordially welcomed the visitors to the city and explained some of the civic conditions which had made Dayton famous. He referred particularly to the commission form of government which the city has adopted; to the flood-prevention measure which is at present being agitated locally and nationally, and which is receiving the hearty support of the citizens of Dayton; and lastly to the Greater Dayton Association, composed of the business men and others who are making every effort to increase the prosperity of the city and improve civic and political conditions.

Following this address a very instructive paper entitled "A Successful House Wiring Campaign," by E. L. Callahan of H. M. Byllesby & Company, of Chicago, was presented by Robert Montgomery, commercial manager of the Louisville Gas & Electric Company. This paper describes in detail the very successful campaign which has been conducted in Louisville during the past two months and is presented in full elsewhere in this section.

A rather complete but informal discussion followed the presentation of this paper, particularly concerning the point of who should do the wiring. It was the concensus of opinion that the best results can be obtained by turning all wiring contracts over to the local electrical contractors and in this way gain their support and co-operation.

The advisability of including fixtures in a house-wiring campaign was discussed and it was thought by many that if the central-station company attempted to specify certain fixtures which should be used, the field of the campaign would be limited; and on the other hand, if sufficient varieties were embodied in the plans to please all tastes the multiplicity of fixtures necessary to display would cause considerable annoyance.

Thomas F. Kelly,
Sales Manager, Dayton Power & Lighting Company, and Chairman, Committee on New Business, Ohio Electric Light Association.

The subject of "Handling of the Chronic Kicker" was then briefly discussed. Parker Kemble, of Cincinnati, voiced the opinion of those taking part in his statement that extreme courtesy on the part of employees is the best manner of meeting kicks. It was also pointed out that every central-station office should be equipped with a private room where persons complaining could be interviewed, as this should not be done in the general offices where the conversation, often heated, could be overheard by customers.

The meeting then adjourned to the dining room, where an excellent luncheon was served. During this Charles Wuichet, of Dayton, delivered a very humorous and entertaining address on the subject of "Hot Air." Following this, Frank M. Tait, president of the Dayton Power & Light Company, spoke briefly of the development in the electrical industry and gave statistics showing that the volume of business doubled every five years. He commented also on the importance of the sales department work and the prominence that this is receiving at present.

R. H. Grant, sales manager of the National Cash Register Company, then gave a very inspiring and convincing talk on sales methods, pointing out that selling is a broad and dignified occupation, where the article sold has merit. He said that if the product is a good one then the only thing necessary to create a desire on the part of the purchaser is education, and this is one of the most important features of sales work. Salesmen to be successful must be observing, must be good listeners, must keep well informed and must be thinkers.

At the opening of the afternoon session, Chairman Kelly reiterated his statements made at previous meetings that the committee is particularly desirous of assisting the smaller companies. He stated that one small company had written to him expressing their need for a competent power salesman, whom they could afford to employ for only a short time. He thought that if this situation existed in a number of localities the committee could well afford to employ a high-class salesman and have him sent from company to company, as his services were desired, the companies to reimburse the committee for the time the salesman was used.

Speaking of this co-operative work, Parker Kemble, of Cincinnati, thought there was a hesitancy on the part of the small companies to ask questions of the committee, and he thought that the best results could be obtained by urging these companies to appeal directly, either through personal correspondence or by a visit, to their neighboring larger central stations. In this connection, A. L. Steele thought that the committee should furnish the small companies with a list of the new-business representatives of all companies in the state so that personal correspondence could be directed to them.

S. F. Messer, of Kent, thought that the managers of small companies should make it a point to cultivate the acquaintance of the managers of the larger central stations and make personal visits to them when information is desired. It is also advisable to take prospective customers to visit successful plants in the larger cities, as these visits will tend to impress upon him the desirability of obtaining service.

The subject of "How the Nitrogen Lamp Can Be Used to Displace Gas Arcs for Exterior Illumination," was then taken up. Parker Kemble, of Cincinnati, referred to the experience of the Union Company in this connection, there being at present about 400 nitrogen lamps on the lines of the company. He described a unit comprising a weatherproof fixture with a 12-inch globe and a 750-watt nitrogen-filled lamp, which the Union Company is placing on a rental basis. The same fixture with 500-watt Mazda lamps are also placed in the same manner and are widely used in Cincinnati. He spoke of the importance of using a proper fixture and reflector in connection with the nitrogen lamp, because of its peculiar characteristics. The company renews lamps without cost but no data are as yet available on the life of the new lamps.

"What Benefits May Be Derived From Commercial Application of Electrical Heating Devices," was the next subject brought up for discussion. It was pointed out by one representative that the revenue from domestic appliances is less than commonly thought and he questioned the advisability of spending money or of having employees devote time to securing this class of business.

Otto Wessel, of Columbus, explained that his company employs a man who devotes his entire time to heating devices. The company considers this profitable both in point of profit from sales and additional revenue from appliances connected. He added that if the householder is educated to the use of numerous electrical devices there is less chance of such a customer ever moving into an unwired house.

Parker Kemble, of Cincinnati, stated that the Union Company employs women solicitors who devote their entire time to this business. The salary is $65 per month and car fare, and they are required to sell devices aggregating $250 per month. They also receive a commission of 10 per cent on all sales above this amount. He added that the appliance department of the Cincinnati company is a profitable one and this would be true generally if price cutting were eliminated. He referred to this as a harmful practice.

The question "What Has Been Done to Develop the Electric Range Load?" was then briefly discussed. It was the general concensus of opinion that with the competition of natural gas in most Ohio cities, the sale of electric ranges even at a low rate for energy was a difficult proposition. Mention was made, however, of the success that is being had in numerous localities outside of the range of natural gas. A particularly good field for this business is in summer-resort districts and along the lake, where there are a great number of summer homes. It was generally agreed, however, that cooking business is not being given the consideration that it deserves. It was also pointed out that while a low cooking rate is necessary to secure the business, it should preferably be a sliding scale rate, as a low flat rate would be hard to justify in case of commission investigation.

The third and last meeting previous to the annual convention of the Ohio Electric Light Association at Cedar Point in July, will be held in Cleveland on Friday, May 22, on "Ohio Electric Light Association Day" of the Cleveland Electrical Exposition.

Electric Incubator and Brooder in Show Window of La Crosse Central Station.

Electric Incubator Makes Striking Window Display for Central Station.

A window display of unique character and which has attracted a great deal of attention is that at the office of the LaCrosse Gas & Electric Company, LaCrosse, Wis. The display, as shown in the illustration herewith, consists of an electric incubator and electric brooder designed and constructed by Anton Anderson, of the LaCrosse Gas & Electric Company. The incubator, loaded with 100 eggs, was placed in the show window and connected to the circuit. At about Easter the chicks appropriately began to make their appearance. As soon as they were hatched they were transferred to the electric brooder to rejoice in their downy bed of cotton, while in their waking hours they ran around in the wire coop in front of the brooder. Thus they afforded wonder and amusement for both children and adults.

The construction of the incubator is as follows: The dimensions of the box are 14 inches high, 35 inches long and 25 deep. This box contains another box therein, which is separated by an air chamber from the outer box. It has four regulating air tubes, two for fresh air, one for regulating foul air and one for ventilating the air in the egg chamber. The fresh-air tubes are on the inside of the box, directly underneath the two lamps, the air coming in passes over the lamps and becomes heated. It then passes over a sheet of steel, lined with asbestos on both sides and formed in a half circle, the upper side of the circle being within two inches of the top of box and being separated by six inches from the lamps. The hot air then passes over the eggs and passes out through the ventilating tubes. These tubes, when once set for the hatch, remain so until the hatch is completed.

The heating apparatus consists of two 10-candlepower lamps, which are controlled by an electric thermostat, which was also designed by Mr. Ander-

son and controls the heat up to 102 degrees. When it reaches that point, the lamps are cut out automatically. The lamps have been colored a very dull red so that the light will not affect the eggs in any way. There is absolutely no waste of current as the lamps are on approximately 30 per cent of the time. The eggs are turned twice a day.

The brooder to be used in connection with Mr. Anderson's electric incubator is constructed as follows: It is 16 inches wide, 48 inches long and 12 inches high and the yard is directly in front of the brooder and is 16 inches wide, 48 inches long and 6 inches high. The brooder is partitioned off into two compartments, the heating and the warming chambers. The heating chamber is seven inches high and the warming chamber is five inches high and lined with canvas and 1-5 inch of cotton batting. This cotton batting is placed on the top side of the warming chamber so that the chicks can warm themselves in the same way as they do when being warmed under a hen.

Heating of the brooder is done electrically by three 10-candlepower lamps controlled by a thermostat. The lamps are directly above the warming chamber and the heat is kept practically at 100 degrees. The yard is separated from the warming chamber by a woolen curtain cut into fine strips so that the chicks can go from one compartment to the other, that is to say, from the warming chamber into the yard, or vice versa, without materially affecting the temperature in the warming chamber.

The front part of the brooder has three three-inch circular windows inclosed in the heating chamber so that the electric lighting effect may be seen. This is for ornamental purposes.

Central-Station Exhibition in Cambridge, O.

The New Midland Power & Traction Company, of Cambridge, O., was largely responsible for the success of the second annual "Made In Cambridge" exposition which was held the week of April 13, and the results that have accrued have more than justified the company's efforts. Over 16,000 people visited the show during the week and the company secured many inquiries which are developing into live lighting and power prospects.

One of the features of the company's exhibit was a large electric sign announcing the name of the winner of the $5 gold piece offered by the company to the school child making the most accurate estimate of the company's gross receipts for the month of January. The contest also included an essay of 500 words dealing with the economy of residence electric lighting.

Commenting on the show, W. S. Hays, superintendent of the Cambridge companys says:

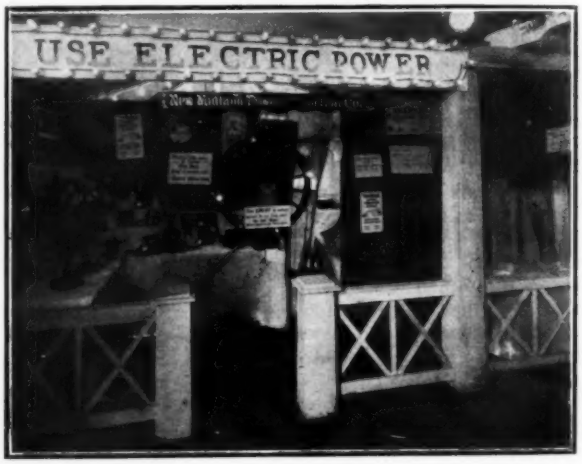
"The show was largely the result of our own personal efforts and as a matter of information, we wish to advise as result since the first show a year ago we have increased the horsepower of central-station motors on our lines by nearly 100 per cent and the number of our consumers by 25 per cent, proving that anything that boosts the town comes back directly and indirectly to the central station and should be pushed aggressively by us all.

"One of the novel features brought out during the show, was using an electric light frozen in a block of ice (which is a by-product of our business) operated by a flasher which attracted a great deal of attention and clearly showed that electric light is as cool as ice.

"Only manufacturing plants were shown in exhibits. A banquet was given on Friday evening to which came men from commercial bodies of Wheeling, Zanesville, Coshocton, Columbus, Pittsburgh, etc. A large electric sign reading "Boost Cambridge" was the center of decorations behind speakers' table."

Utilities Company Maintains Electric Cottage.

What is proving a most effective method of demonstrating the great variety of uses to which electricity may be put in the home, is in use by the Utilities Company, of Lexington, Ky. This company is maintaining what is termed an "Electric Cottage." The dwelling, which was furnished by the various house furnishers of the city, is complete in every respect, from the kitchen to the bathroom and contains all the electrical conveniences that are possible in a residence. The company, in announcing the opening of the cottage, issued an invitation to Lexington people to avail themselves of the convenience of the house, as a meeting place, as a rest room, as a place to obtain refreshments, and as a place to see what electricity can do to make life easier and pleasanter. Demonstrations are conducted daily by girl graduates of the Harrison school of applied electricity, assisted by members of the junior class of the Department of Domestic Science of the Kentucky State University. All the numerous cooking appliances are shown in operation, as are all the electrical contrivances which are useful in the home. One thing in particular which is graphically demonstrated is the electric burglar alarm set up in the bedroom of the cottage.



Central-Station Exhibits at "Made in Cambridge" Exposition.

Telephone communication will soon be opened between the European cities Berlin and Milan.

A SUCCESSFUL HOUSE-WIRING CAMPAIGN.

By E. L. Callahan.

Comparatively few cities in this country have as many as 50 per cent of the houses wired for electric light out of the total in the city which could reasonably be expected to use electric light. In Eastern cities this percentage is probably as low as 25 per cent, therefore, the outline of a practical house-wiring campaign, that has been tried and found successful will, without doubt, be of interest to all central-station companies.

A house-wiring campaign was started in Louisville, Ky. (population 250,000), about two months ago, with the result that the Louisville Gas & Electric Company is now adding to its lines an average of 70 old houses per week, from the campaign proper, with a total result of approximately 150 new residence consumers each week, as the direct and indirect result of the house-wiring campaign. The average cost of the wiring, including fixtures and 40-watt Mazda lamps, is $36.43 per house. In starting this campaign in Louisville, the residence portion of the city was divided into five districts, with one house-wiring salesman being assigned to each district. It is estimated that there are approximately 40,000 residences in Louisville and that, of these, there are 15,000, at present, connected to the company's lines. Assuming that 50 per cent of the remainder is prospective, at this time, we have approximately 12,500 old unwired houses which are considered prospective lighting consumers. It is the intention, in Louisville, to keep this campaign going for at least a year, or until practically every home in Louisville is wired or connected to the company's lines should it be found that some of these houses are already wired but are not connected. If a thorough canvass were made, in any city in the United States, to ascertain the number of houses wired, but not connected to the lighting company's lines, the result would be surprising. In one large city such a canvass showed that there were as many houses wired, but not connected, as there were of residences taking service from the lighting company.

Difficulties Encountered in Launching a Campaign:

Many central-station companies have discontinued the practice of selling appliances and doing house wiring, and not desiring to enter into this business, even temporarily, they are often confronted by difficulties which seem almost unsurmountable, especially when it is a question of making satisfactory arrangements with the electric contractors to do the work. This difficulty was experienced in Louisville since the Louisville Gas & Electric Company do no piping or wiring, nor do they sell appliances or any kind, this being the policy at all Byllesby properties. Therefore, with a view of enlisting the necessary assistance to carry out such a campaign, the contractors were invited to attend a noonday luncheon for a conference. The entire matter was laid before them. They were given figures showing the large field of operation. The campaign was carefully outlined and the number of unwired houses in Louisville calculated. The contractors were given to understand that the company would spend a large amount of money in advertising the campaign in the daily newspaper, through hand bills, and, through its five salesmen, would be able to hand them a large volume of business which would warrant their making prices that would be satisfactory to carry on a successful campaign. It was pointed out to the contractors that they could pool their interests, purchase materials, as a single jobber, and effect economies in taking care of the business handed over to them by the lighting company, to say nothing of other business which would come directly to them at a much lower cost than they have ever been able to do heretofore. These contractors were requested, at this meeting, to submit specifications and quotations, on a flat-rate basis, making a price, per outlet, for the wiring, also a flat price for each fixture, hung complete, ready to burn, including 40-watt Mazda lamps, figures based on the Tungstolier line of fixtures. The Louisville Gas & Electric Company proposed to bear all expense of a vigorous advertising campaign and to have five of their salesmen, referred to above, secure the house-wiring contracts, contracts to be taken between the consumer and the contractor, the company not being a party to the contract, but merely acting as a sales agent. The above plan, it will be seen, does not necessitate the contractor spending any time in obtaining the business. In view of these facts, and considering that contractors would be relieved of all advertising and selling expense, as well as the cost of making estimates, it was reasonable to expect some very attractive prices from them.

Contractors' Prices High.

After due deliberation, the contractors submitted specifications and quotations, which were rejected by the company, because they were too high to make the campaign a success, in fact, the prices were no lower than the average price regularly charged.

An application blank was then compiled by the company which constituted a form of contract between the contractor and consumer, in which the contractor agreed to do the work, on a time payment plan of 25 per cent cash, on completion of the work, the balance to be paid in twelve equal monthly payments, the entire charge subject to a discount of 10 per cent in the event the consumer desired to pay cash within ten days after the work was completed. The contract blank was prepared in such a way that it was a very easy matter for the consumer and salesmen to select the fixtures and the kind of wiring, location of switches, etc., best suited for the particular residence and ranging in price from $10 to $150, as best suits the pocketbook of the consumer. On the second page of the application was the schedule of fixture prices, which prices were revised upon the announcement of the General Electric Company that the manufacture of Tungstolier fixtures would be discontinued. The wiring specifications and schedule of prices are shown herewith. As soon as this application had been compiled, it was submitted to the contractors. They considered the prices entirely too low and, in a body, refused to take up the work at the prices named.

One Contractor Accepts Company's Schedule.

Fortunately, a few days later, one contractor voluntarily accepted the company's schedule of prices and contract, providing the company turned over to him all of the work. After the company had satisfied itself as to the ability of this contractor to finance such a large business, on the time payment plan, the campaign was launched.

In addition to the large number of contracts that the company is turning over to the contractor, he is now receiving practically an equal volume of house-wiring business which comes to him without solicitation, induced, no doubt, by the advertising of the company's campaign.

All Electric Contractors Benefited.

All the other contractors are apparently doing a much larger business, since the campaign was started, than they had been doing before. Also the sale of portables, electric irons and other appliances has increased materially, at all supply houses and dealers. The contractor, to whom the company turns over the fiouse-wiring business, found it necessary to perfect an organization capable of handling such a large business efficiently and included in his new organization is a credit man, who passes on all accounts; a trained fixture salesman in charge of fixture room, who takes care of the many customers who prefer to call and see the

fixtures, rather than select them from a salesman's catalog, and an outside superintendent in charge of 42 wiremen.

The capital required by the contractor to carry on the business, as outlined above, is approximately $25,000 and, to be successful, a contractor must carry on and watch his business as carefully as any successful merchant would.

Cash Prizes to Salesmen.

As evidence of the contractor's satisfaction with the prices adopted in Louisville, it should be noted that he voluntarily furnishes to the commercial department of the Louisville Gas & Electric Company $10 per week, which is given as prizes to the two salesmen securing the largest number of house-wiring contracts each week, $6.00 to the highest man and $4.00 to the next highest. In addition to these prizes, the company gives a cash prize of $10 to the salesman showing the highest efficiency each month, a certain percentage being added for every kilowatt contracted for and connected, also for working overtime, turning power prospects over to power and gas salesmen, taking care of complaints, etc., a deduction being made for tardiness, carelessness and for other similar reasons. The relative standing of each man is posted daily on a blackboard in the commercial department which has resulted in a keen rivalry for first place. The entire commercial department of the Louisville Gas & Electric Company hold a meeting every Saturday afternoon, presided over by Mr. Montgomery. At this meeting a paper is read on some subject of general interest, a lively discussion following. These papers and discussions have proven very attractive and beneficial to the department and to each of the salesmen individually.

It was decided that, while public interest is aroused because of general publicity and the special advertising by the company, that the sale of electric irons could, at this time, be stimulated effectively. A large retail tea and coffee company in Louisville, that sells about two dozen staple groceries, on the premium plan, purposes to add to its premium list the choice of two standard electric irons, the premiums being distributed upon delivery of the first pound of tea or coffee, after signing an agreement to take a certain quantity which entitles the purchaser to the premium. It is thought that, through this medium, this aggressive concern, with seven delivery wagons in Louisville, will be able to place a large number of irons on the lines of the company within the next few months.

Any campaign for business can be made successful if planned along the right line and then carried out with the necessary steam back of the efforts exerted.

The reason many house-wiring campaigns "peter out" is not because the plan was wrong but because the one in charge or responsible is asleep at the switch. All effective advertising must have a punch. The efforts of a department manager, to be successful, must be stimulated by the determination to win. A house-wiring campaign, or other campaign, in the hands of such a man will be successful because it will not be launched until he knows the plan is right and that he can put it into successful execution.

Plowing by Electricity in Italy.

Consul L. J. Keena, Florence, Italy, reports that some experiments have recently been made near Florence on plowing by electricity, following the example set by landowners in the department of Emilia. The stationary apparatus drawing energy from some commercial electric line consists of transformers, motors from 25 to 50 horsepower, motor-driven capstan, and hauling cable. The running apparatus is made up of a leading truck and wheeled plows. It is stated that 89 acres can be plowed without shifting the stationary plant.

At Gazzo Veronese the following estimates of the cost per acre of plowing were made; Plowing with animals, $5.30 to $5.75; steam power, $4.30; electric power, $3.00. The plowing was done to a depth of 13.78 to 15.75 inches, and the foregoing cost of electric plowing is figured on the basis of 200-days' work per year with electric power at the rate of three cents per kilowatt-hour. In the same district for 100-days' work in the year with the price of electric power at four cents per kilowatt-hour, the comparative costs per acre of steam and electric plowing were: Steam plowing, $5.07; electric plowing, $3.35. Other plants in the same district are said to have reduced the cost of electric plowing to $2.83 per acre.

Near Piacenza on a two-acre tract the expense for plowing to a depth of 17.72 to 19.68 inches with electric power, was $4.00 per acre. The plowing was somewhat deeper, the cost of electric current was five cents per kilowatt hour, and the land was cut by a highway running through it.

Calculations made at Reggio Emilia on 741 acres plowed by electric power showed the total cost to be $4,324, with power at 1.6 cents per kilowatt-hour. For other systems using a moving engine the costs of plowing a similar parcel of land figured on the same basis, were: Plowing with steam power, $4,360; gas engine, $4,368; oil burning engine, $4.285.

The cost of fuel in this district is approximately as follows: Coal, per long ton, $12.20; wood, per 220 pounds, $0.80; gasoline, per five-gallon tin, $1.80; kerosene, per 200 pounds, $7.00.

Bristol Company Utilizes Show Windows for Manufacturer's Display.

In Bristol, which lies on both sides of the Tennessee-Virginia line, the Bristol Gas & Electric Company is using the latest and most up-to-date plan for the popularization of electricity as power. The company is one of the enterprises of Henry L. Doherty & Company, of New York, and the power and current it distributes comes from the power dam and plant of the Watauga Power Company, situated on the Watauga River about nineteen miles from Bristol. The Doherty Company purchased this property some time ago, and is in position to make a most liberal offer to the manufacturers and people of Bristol. In many of the manufacturing establishments of Bristol, which is a thriving city of 20,000 people, electricity has already supplanted steam as power and the low rate has resulted in making the city what its inhabitants boast the "best lighted city of its size in the South."

By way of encouraging the manufacturers who have become converts to the electric motor power and to impress upon any others the desirability of making the change, the Bristol Gas & Electric Company has for the last six or seven weeks maintained a series of displays in the show windows of its office building. Each week the show windows are devoted ot the display of a manufacturer using electric power. One of the company's two big windows serves to display samples of the company's finished product while the other shows the actual process in the making of the whole or a part of the finished article. This moving display is, of course, operated by electricity, the power for the purpose being furnished by the company free to the exhibitor.

Convention of Doherty Managers.

The operating heads of utility properties controlled by H. L. Doherty and Company, to the number of 148, met in convention at New York City recently. The companies represented are distributed over 24 states.

F. W. Frueauff and George Williams presided at the sessions, which totalled ten in number, and were devoted to commission relations, auditing, gas, public relations, new business, welfare and safety, statistics, and electric vehicles.

Electric Sign Data

Electric Signs and Moving Pictures.

In a recent issue of *Electric City*, published by the Commonwealth Edison Company, the following editorial relative to electric signs appeared:

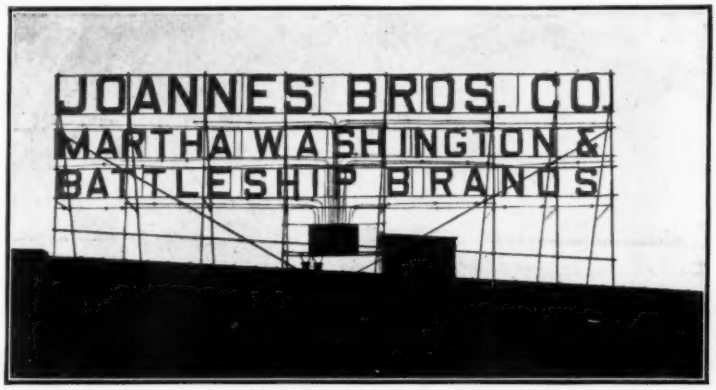
Under the title of "Electrical Movies" Ivan Heald, a clever special writer on the London *Express* describes a novel form that refers to the spectacular signs which every live town can now boast. Many of these are elaborate enough to fully warrant such a title; some show electric interurban trains, some show steam locomotives in motion with the operation of the semaphores or block signal systems, others show automobiles traveling apparently over smooth roads, the wheels revolving rapidly, the veils of the lady occupants blowing gayly in the breeze, and perhaps even include, as one such sign in Chicago did, the representation of a dog running near the hind wheel.

It is not too much to say that there is hardly any motion picture requirement which is beyond the resources of the builder of the electric sign and the builder of flashers, as developed today, to produce with such a degree of realism and such complete illusion that even the most sophisticated must needs stop, if not to wonder, at least to approve. For a long time past one of the most noted moving effects in electric signs has been the chariot race scene from Ben Hur, which was the distinguishing feature and the principal attraction of a very large electric advertising display in New York City. Its proportions were enormous, the expense of construction and erection was very heavy, and yet it is probable that the investment was extremely profitable, as it was really one of the sights in New York, which is saying a good deal for an "ad."

Colored lights in large signs used to be more of a problem than they are now. In the old days if a man wanted colored lights in his sign he had to either buy colored glass lamps, which were very expensive, or else go to almost equally great expense to maintain the colors on the lamps by means of dipping them, and they had to be removed and redipped frequently on account of the weather, which disintegrated and washed off the coloring matter. Now, colored tips with little wire springs holding them to the lamp bulbs, may be had in any shade. They are very cheap to buy and last indefinitely, being quickly applied to a new lamp if the old one burns out and has to be renewed.

There is no more wonderful development in the art of advertising than the development of the flashing electric sign. It is far more remarkable than billboards or any kind of street advertising, because it is there in living light against the background of the night sky. Yet many a merchant is overlooking a golden opportunity by not erecting a roof sign on his own premises, and this is probably due to the fact that it takes a little thinking to figure out just what is best to be done in the circumstances. There is no doubt that an unique, distinctive, individuality is of great value in such a sign, especially as they are increasing in number. Such a sign becomes a trade mark, indicating that particular advertiser to the public as far as it can be seen, and these roof signs may be seen literally miles away. But it is a matter that is worthy of the attention of every business man who deals directly with the public, or indirectly through retail dealers handling his product.

The prominent thoroughfares of any town at night are now the theaters at which the "free electrical movies" are regularly displayed. They are free if anyone cares to travel on foot, but seats are charged for at the rate of five or ten cents. However, one can ride many miles, taking in the numerous signs en route.



Electric sign manufactured by the Federal Sign System (Electric), Chicago, Ill., and sold to a wholesale grocer of Green Bay, Wis., through the Wisconsin Public Service Company.

Sign is 56 feet long and 30 feet high and contains approximately 800 five-watt tungsten lamps.

The top line showing the firm's name is in four-foot letters and is fastened to the framework permanently. In the two lower lines the letters are interchangeable and an extra stock of letters is carried so that the various brands carried by the company can be spelled.

A flasher flashes one letter at a time until all are lighted, then all are cut off and the cycle repeated.

The approximate cost of this sign is $1,200.

Novel Electric Sign of the State of Utah.

The Manufacturers' Association of Utah has recently installed a unique slogan sign in front of the Chamber of Commerce Building, Salt Lake City. The sign was first used at the exhibition of Utah products held in the Keith Building on Main Street, Salt Lake City, April 2 to 9.

The sign represents a map of the state of Utah with its principal geographical features, including counties, lakes, rivers, mountains and principal cities painted on the background. The borders of the state are marked by a border of incandescent lamps and the words, "I am for Utah" are outlined in raised letters on the face of the sign. The state emblem, a beehive, is depicted in incandescent lamps in the upper right-hand corner of this attractive sign.

Electrical Construction

SOME INSTALLATION FEATURES OF THE NEW ELECTRICAL LABORATORY OF THE BUREAU OF STANDARDS.

By P. G. Agnew.

In a separate article on page 811 a brief description is given of the general laboratory features of the new electrical building of the Bureau of Standards in Washington, D. C. Some of the constructional features of the installation and equipment are described in this article.

The new electrical building of the Bureau of Standards is connected with the power plant of the Bureau by a tunnel carrying all piping and wiring, and large enough to serve as a convenient passageway. The piping and wiring for the laboratory work is carried through the sub-basement to the bottoms of four shafts, from which the various rooms are supplied.

The wires for laboratory use are carried around the walls of the rooms, chiefly on the outside walls, in a special form of oak conduit. This somewhat unusual method was adopted in order to secure flexibility, as experience has shown that it is very desirable that the wiring be accessible so that changes and additions may be readily made, particularly where research forms a very considerable part of the work. The conduit was given a fireproofing treatment by the application of a solution of 22 ounces each of ammonium phosphate and ammonium sulphate to a gallon of water.

For convenience in carrying the conduit and the piping for water, gas, compressed air and vacuum from room to room continuously, vertical slots 4 by 16 inches were left in the partition walls where they join the outside walls. The arrangement is shown in Fig. 1. The pipes are carried on the walls just below the conduit.

Lighting and power circuits are kept separate throughout, and both alternating and direct-current power are available in the laboratory conduit, usually being brought to Hubbell outlets, in order to avoid the inconvenience and unsightliness of connecting laboratory devices to lamp sockets. The lighting circuit is supplied by the power plant of the Bureau, but may be connected to the city alternating-current mains when necessary.

The switchboard panels in the dynamo room, which is entirely distinct from the general power plant, are all of special design, as unusually great flexibility is required. The main switchboard rests on a base of gray brick, to match the wainscot of the room. Plug panels form a most important part of the board. Fig. 3 shows the construction of the plugs and sockets used. There are 10 small boards scattered throughout the building, but placed at openings into the four pipe shafts. These small boards are connected to the main board in the dynamo room by trunk line, and each of them serves a group of rooms. One of them is shown in Fig. 4.

Motor-Generators.

The dynamo room at present contains seven motor-generator sets for various kinds of special work. They are all special machines, the wiring on some of them being quite complicated. For example, one set has eight three-phase alternators on the same shaft, and all leads are brought out so that each machine may be connected either star or with completely separate phases, and as many of the generators as may be desired can be connected in series for building up different wave-forms. In addition, the stator armature of any generator may be mechanically rotated in reference to the others, for adjustment of phase relations.

The machines are all mounted on a single massive concrete slab, which rests on sand and is mechanically distinct from the floor and walls of the room. Fig. 6 shows the construction of this slab. The waterproofing was put in primarily to prevent water from the cement reaching the dry sand while the cement was being poured.

The larger motor-generator sets are connected so as to run from five-wire circuits, so that when being run from storage battery the fields are put across

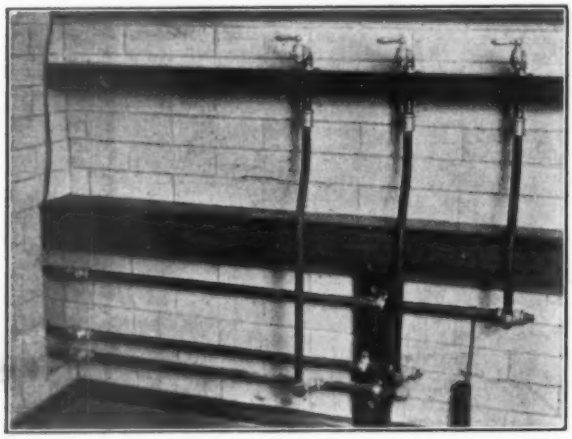


Fig. 1.—Wall Slot, Oak Conduit, Piping and Bench Rail.

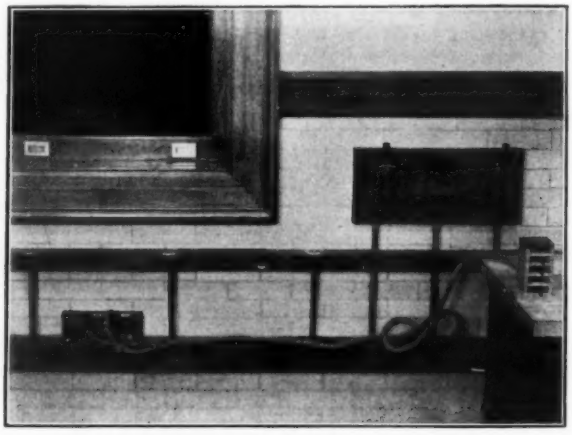


Fig. 2.—Remote-Control Jack and Controller.

the whole battery while the armatures are connected to the end-cell switches. This gives a better speed regulation, and at the same time is better for the end cells of the battery. Three of the machines are operated from the laboratory where they are most used, instead of from the dynamo room.

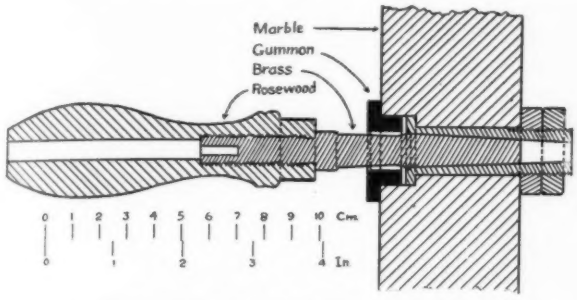


Fig. 3.—Details of Plug and Socket for Plug-Boards.

Remote-Control System.

A somewhat complicated system of remote control for the motor-generator sets has been installed. The arrangement is such that by merely plugging in a special jack one may have complete control of the speed and generator voltages of a motor-generator set in any one of eight rooms. The phase relation between voltages is included in the control, as well as a rheostat for the control of direct-current voltage. A single five-lever controller is used. Each lever has two speeds ahead and two reversed, the high speed for rough, quick adjustment and the low speed for accurate setting.

The field rheostats are made of 1.25-inch brass tubes insulated and wound with a large number of turns of resistance wire, up to as high as 12,000 turns on the longest tubes, which are cooled by water circulating through them. Contact is made by means of a traveling brush which is operated by a worm-geared motor and cord. The tubes are from 18 to 38 feet in length. By attaching one terminal of each motor armature to the neutral of the supply mains the wiring is so simplified that only one wire from each motor is carried to the laboratory in addition to the power wires. Two 10-volt batteries are connected to the neutral of the three-wire power system, giving a five-wire arrangement by which the two-direction, two-speed drive is secured. A simplified diagrammatic wiring scheme is shown in Fig. 5. Switches are placed at the ends of the tubes to automatically stop the traveling brush at the limits of its travel. The gain in ease and flexibility of control and in the general efficiency of operation is most marked, as compared with methods formerly used.

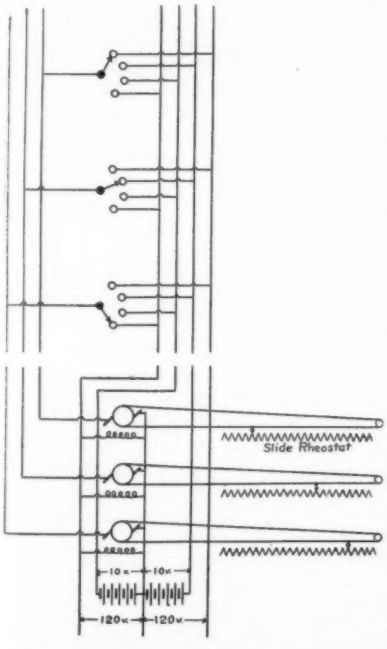


Fig. 5.—Remote Control Circuits with Two-Direction and Two-Speed Adjustment.

Heavy-Current Apparatus.

Four large storage cells allow direct-current testing to be carried up to about 10,000 amperes. They are arranged for connection in series-parallel groupings for discharge at 2, 4, 6, or 8 volts by means of single-pole double-throw switches. As the chief consideration is to keep down the drop in conductors, the busbars leading from the battery are 1 by 8-inch copper slabs. Connected into the busbars is a large oil-immersed water-cooled resistance standard and a control rheostat. The resistance material in the latter is in the form of flattened tubes through which water circulates for cooling. Heavy laminated copper brushes, similar in construction to those used on large circuit-breakers, bear directly on the resistance tubes. The brushes are operated in pairs by small motors connected according to the remote-control system described above.

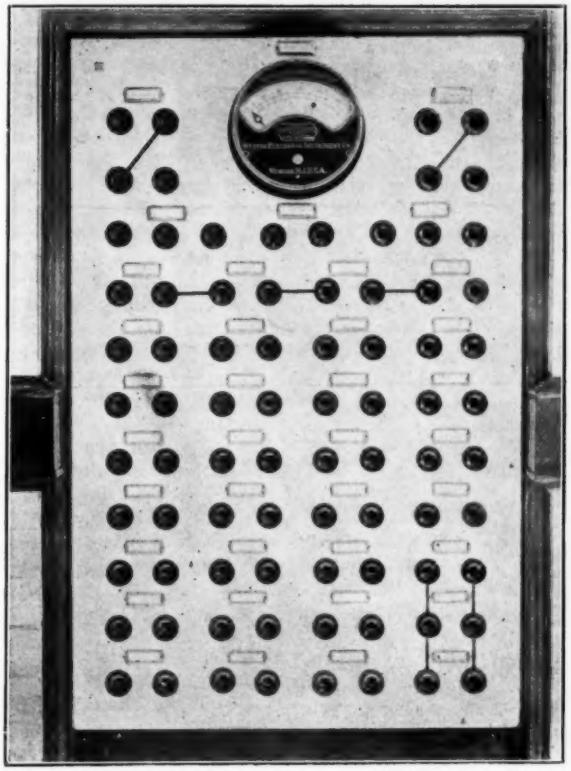


Fig. 4.—Small Plug-Board.

An interesting detail of the design is a 10,000-ampere mercury reversing switch which is really a part of the busbar. The 1 by 8-inch slabs merely overlap for a few inches, and one-eighth-inch spaces or pockets provided between them are so arranged that mercury may be flowed between them, forming an electrical connection. The mercury is covered by a thick layer of kerosene to prevent deterioration of the amalgamated surfaces.

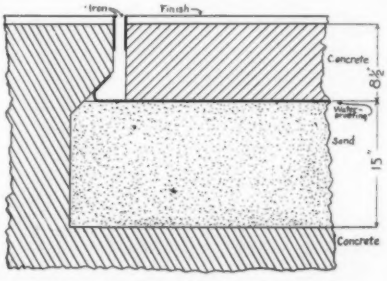


Fig. 6.—Concrete Machine Foundation.

Life Test of Incandescent Lamps.

A 40-kilowatt, 60-cycle alternator direct-connected to a high-speed engine supplies the power for the life test of

incandescent lamps. This unit, which is in another building, carries no other load, and the voltage is controlled by a Tirrill regulator. In the life-test room is a large group of autotransformers for controlling the voltage on the various racks. The final adjustment is made to the nearest 0.2 per cent by means of dial switches on the autotransformers.

The racks themselves are mounted on asbestos board and supported in banks of six on substantial iron uprights. The racks carry sockets for burning lamps in either a horizontal or in a vertical position. There is provision for 1,296 of the former and 1,200 of the latter.

STRINGING A TRANSMISSION LINE.

By R. S. Hartley.

For the purpose of stringing out and stretching wires on a small transmission line, or for instance a three-phase line, or a rural telephone line, the method which I have used with the best success is to rig up a farm, or other ordinary wagon (even a light spring wagon will do for light lines) in somewhat the manner shown in Fig. 1. The wagon should preferably have a good brake, as shown at *D*, with its attachments. Where such a wagon is not available a log or timber from eight to twelve inches in diameter may be hung from the axle and dragged behind the wheels, as shown at *E*, or arranged to be dropped behind the wheels wherever it is desired to stretch the wires. Either of these devices will be found efficient in providing a stationary anchor.

The reels, whether one, two, or three, are bolted to a plank in a secure manner and the plank secured to the wagon box, so as to leave no chance for play. There are several types of reels on the market, some having a device which prevents the wires from paying out too rapidly. Personally I use the plain pay-out reel and arrange a friction on the rear of the wagon, by means of blocks of wood bolted to the wagon box, in such manner that the tension can readily be adjusted. The reels must be mounted so that they will not interfere with each other, and must be free from the wheels of the wagon and the box. Where three are used, the rear one should be mounted about eight inches higher than the others; this I usually set on a two-inch plank fastened to the box.

The coils of wire are set on the reels in such a way that the wires in paying out will come from the outside of the two reels in front so as to escape any interference with the rear reel, and then are passed through the frictions located on a piece of four-by-four spiked to the wagon box. Fig. 2 will show the kind of friction we use. Hardwood blocks about 3 by 8 by 1.5 inches make good bolts, having the heads countersunk underneath to use for adjusting the friction; the tension should not be great enough to burn the blocks—the lightest touch is sufficient to prevent too much slack running back in the line.

I prefer to stretch the wires at each pole and let the lineman put on the brackets, or insulators, take up the wires, and tie them in with one trip up the poles, where small wires are being used.

When the lineman has the wires on the brackets, or over the cross-arms, and is ready to tie them in, the wagon man brakes his wagon or drops the log behind it, attaches the two or three come-alongs and blocks to two or three wires of the circuit, stretching them so that the strain on all is about the same; the lineman then ties them onto the glass insulator with a good firm tie, and the line work to that pole is complete.

The splices that must be made between the ends of the coils and the line that has been paid out, should be either soldered or made with some form of sleeve so that there will be no chance of pulling them apart in stretching, or of poor electrical conductivity; this can be done best at the rear of the wagon on the ground, and if the man on the wagon be somewhat of an electrician he can do this without needing the help of the lineman, so as to minimize the amount of delay, which is usually quite important.

I have found that wires can be strung on poles with some variations of the above plan, and with less detail, but the time spent on building a substantial suitable rig, and the small outlay for materials needed for the above will all come back many times over in the time it will take to get the wires up and the line finished.

One wagon man, if he be somewhat of an electrician, should be able to take care of, and keep ahead of two or three linemen, or a line can be put up in good time with only one lineman.

The ordinary tie wire, of the same quality as the line wire, is used. If clinched tight with pliers after the line has been stretched it will prevent practically all slip. At the end of the line the wires should be carefully dead-ended, and the end poles well guyed, as the end pole must sustain all the pull on the entire line. When stretching from pole to pole the tendency is for the pole to bend back after the strain is taken off, and this must be overcome, by very rigid guying and heavy pull at the end span. Also it is good practice to install an occasional head guy from the head of one pole to a place on the next pole about eight feet from the ground; this will relieve some of the strain on the end poles and prevent undue sag should the line become broken somewhere along its length.

When unreeling from the wagon it is no difficult matter to arrange the transpositions that are ordinarily placed in the lines about every half mile; this change in the position of the wires on the pole reduces the induction and consequently the noise, if on a telephone line, and helps to balance the phases on a transmission line.

Naming the pins or brackets on the pole 1, 2 and 3, the wire that has been run on 1 is shifted on the transposition pole to position 2, 2 is shifted to 3, and 3 to position 1.

Where running all wires on one cross-arm, as is done on a telephone line and on some transmission lines where the voltage is not too high, I prefer the duplex pin as a means of changing the position and keeping the wires well spread in passing each other; the right-hand wire goes to the top of the pin, the left to the end of the pin below the arm; on the next pole the wire from the top goes to the left

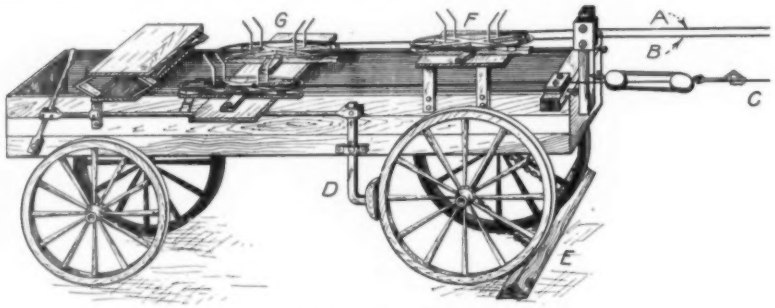


Fig. 1.—Method of Mounting Wire Reels on Wagon.

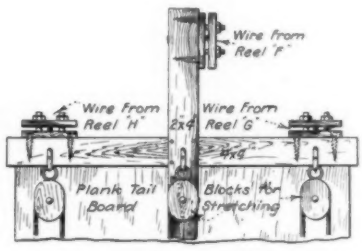


Fig. 2.—Construction of Friction Device.

pin, and the bottom wire to the right.

Where the voltage to be used on the circuit is over 5,000, the usual method is to string the wires on two cross-arms, one wire on the upper arm next to the pole and the other two of a three-phase circuit on the outer pins of a four-pin arm, thus giving wide spacing; where this method is used no transposition pins are needed.

How Many Contractors Lose Money.

The Gibson Electrical Supply Company, of Oakland, Cal., has been distributing among its customers two sets of figures which go to illustrate how a contractor may lose money by not making a sufficient allowance for overhead expenses. These two tabulations are given below. One represents the monthly account of a contractor who is doing a business of $1,000 per month and who finds his overhead expense to amount to 22.4 per cent. The other is a contractor doing a business amounting to $300 a month, who finds his overhead expense amounting to 24.2 per cent. The latter had been figuring prices at 30 per cent above the cost of labor and material and it turns out that he is losing money.

The following figures apply to a man doing a business amounting to $1,000 per month, and allowing himself a salary of $100:

Liability insurance	$ 4.00
Fire	1.00
Electricity or gas	2.00
Water	1.50
Telephone	3.00
Entertainment (cigars, etc.)	5.00
Carfare and express	10.00
Stationery (printing, stamps, books, etc.)	2.50
Losses—	
Bad accounts, attorneys' fees, allowances on bills, etc., 2.5 per cent.	25.00
Breakage on materials and goods not charged up but used, 0.5 per cent.	5.00
Auto (original cost $850)—	
Depreciation, 20 per cent per year	14.00
Upkeep—tires, gasoline, oil, repairs	25.00
Interest on investment, 8 per cent per year	6.00
Interest on capital invested ($1,500) otherwise than auto	10.00
Rent of store	35.00
Boy's wages	25.00
Half of owner's time	50.00
	$224.00

The total overhead expense is 22.4 per cent of total volume of business. If all work was figured at 40 per cent above cost of labor and materials, the gross profit would be $286. The net profit is $286 less $224, or $62.

Next consider the case of a man carrying on a business of $300 per month without the use of a store or office, doing most of his own work, but employing one man.

Liability insurance	$ 1.90
Carfare	9.00
Stationery and postage	2.80
Six per cent allowance on bills and bad accounts	18.00
Expense for tools	1.00
40 per cent of own time spending soliciting, collecting, getting material, etc.	40.00
	$72.70

The total overhead expense is 24.2 per cent of business done. If prices are figured at 30 per cent above the cost of labor and material, the latter amounts to $231. Adding to this the overhead expense gives $303.70, so that the contractor is losing $3.70 per month. If he used 40 per cent instead of 30 per cent in figuring prices, his returns would be $323, giving a net profit of $19.30.

Licensing Electrical Contractors in Chicago.

In our issue of April 4 we published extracts from the report of the Committee on Legislation of the National Electrical Contractors' Association. This report dwelt on the laws and city ordinances now in effect in the United States concerning the licensing or registration of electrical contractors. One of the extracts from the report that was published on page 673 referred to the Chicago ordinance as follows:

The recent Chicago ordinance is not satisfactory as it does not provide for an examination, and anyone can secure a license by paying the required fee, and being vouched for by two citizens. Under this ordinance they have issued licenses to sign manufacturers, real-estate dealers, piano manufacturers, hardware dealers, plumbers, etc.

This paragraph came to the attention of Ray Palmer, commissioner of gas and electricity of the city of Chicago, who has written concerning it to Paul H. Jaehnig, Newark, N. J., chairman of the committee, whose report was quoted. The body of Mr. Palmer's letter follows:

"The impression obtained from a reading of the paragraph above cited is that the Chicago ordinance on the registration of electricians is not satisfactory, and that licenses are being promiscuously given to sign manufacturers, real estate dealers, etc. This, however, is absolutely incorrect, at least insofar as the impression conveyed to the reading public is concerned. Licenses are issued to sign manufacturers, real estate dealers, etc., but in every case such sign manufacturer or real estate dealer must have in his employ an electrician who must show to the satisfaction of this department that he has had the necessary experience and is competent to act in such capacity. In all cases the qualifications of these supervising electricians are very closely investigated and every effort is made by the department to assure the work being done under such supervision.

"I would call your attention to the fact that this ordinance is the result of five or six years' work on the part of those interested, and would further call your attention to the fact that in the drawing up of this ordinance the Chicago Electrical Contractors' Association took a very important part, and the ordinance as submitted and passed met with their approval.

"While it is possible that the Chicago ordinance is not all that might be desired from a 'contractor's' point of view, still as it is the result of work on the part of the Chicago electrical contractors' associations and was acceptable to them, it would appear to me that no published report made by a committee of the contractors' associations should attempt to criticise the same without there being very good grounds for such criticism.

"From the standpoint of inspection and the interest to the general public the ordinance is working out to the very best satisfaction.

"If the present ordinance is not satisfactory to the contractors, I should be pleased to have the contractors from the Chicago Contractors' Association submit any suggested changes that they think advisable and that they believe could be obtained; or if any case is known where this department has issued certificates to electricians who are not competent to receive the same I should be pleased to have this called to my attention."

Among the Contractors.

The Pacific Fire Extinguisher Company, of Portland, Ore., is completing the electrical installation, including wiring and switchboard, in the Pacific Telephone & Telegraph Company's new building at Portland. This company has recently completed the wiring of the Northwestern Bank Building, Portland.

The Ralston Electric Supply Company, electrical contractors and dealers of Albany, Ore., has recently completed the electrical installation, including fixtures, in the new First National Bank Building, of Albany. This installation is in conduit throughout. Another installation under way and nearing completion, is that in the new Carnegie Public Library in Albany, the contract covering wiring and fixtures. The company is adding a complete line of automobile accessories to its present stock, and is also increasing the floor space of its fixture display room.

The contract for the lighting and power installation of the new Child's restaurant, which is being built on Fourth Avenue, Louisville, Ky., was awarded to the Harry I. Wood Company of that city. The wiring will be installed in iron conduit throughout and will include the circuits for 15 semi-indirect lighting fixtures, ceiling and bracket fan, and about 12 motors.

The Bradshaw Electric Company, comprised of William Bernhardt and W. F. Marten, has taken over the business of R. H. Bradshaw in Berkeley, Cal.

The Neal Electric Company has just been established at 209 South Sixth Street, Louisville, Ky., by Joe Neal, formerly with the Harry I. Wood Company, and his brother, Marshall Neal, who has been in the electrical contracting business in Los Angeles, Cal. The company is handling the Sterling Mazda lamps.

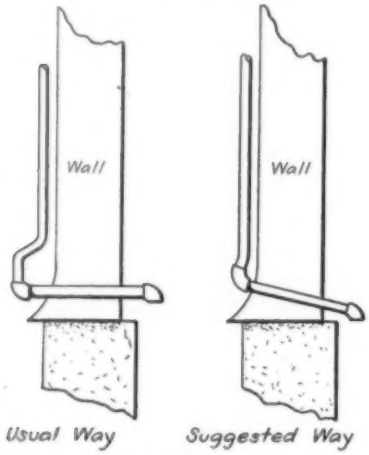
Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Installing Service Pipe.

A great many houses that are being built have a slight curve outward at the point just above the foundation where the shingles start. In putting a service pipe into a house of this kind, it is hard to do a neat piece of work unless the hole is bored at an angle below the horizontal and the pipe bent as shown in the sketch. If the hole is bored horizontally, it is necessary to make an off-set in the pipe which does not look well.

E. W. Dullea.

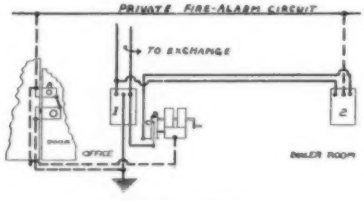


Service Entrance.

Ringing Circuits for Party-Line Telephone Service.

We have central-energy telephone service to our power plant consisting of one metallic circuit with grounded ringing. There are two instruments on the line, one, No. 1, in the chief engineer's office, and the other, No. 2, in the boiler room. It is desirable that the bell of No. 2 shall not ring when there is anyone in the office to answer at No. 1; but that when the office is closed, which is all night and frequent intervals during the day, that the bell on No. 2 shall ring in order that the call may be answered. It is also desirable to have some method for signalling No. 2 in case some one wishes to converse with an employee in the boiler room but is answered from the office. The sketch below shows the result of an effort to meet the above conditions without the expense of running another line to the boiler room from the office, or the use of switches which would depend upon some one remembering to close them at certain times or under certain conditions. The only extra wiring necessary is shown by dotted lines.

The two locks on the door at *A* are arranged so that when the spring-lock is closed the private fire-alarm line is grounded. As the ground wire has been taken off No. 2 and a tap from the fire-alarm substituted, No. 2 telephone will ring only when lock *A* is closed, that is, when there is no one in the office. When the office is occupied and a call comes for someone in the boiler room, only the office bell rings, in which case the party answering turns the magneto in the office. This magneto is one that was taken from an old telephone. When the crank of the magneto is turned it moves to the left, thereby closing contacts *B* and opening *C*, thus disconnecting the right-hand wire of instrument 2 from the rest of the line and throwing the ringing current to the two right-hand binding posts of No. 2, which are the proper ones for ringing. When the crank is released the contacts resume their normal position, thus disconnecting the magneto entirely from the line and completing the telephone circuit through *C*.



Telephone Circuits.

At first I anticipated trouble on account of having to ground the private fire-alarm wire, but it has proved to be an advantage as now whenever another ground occurs on the line, an indicator bell rings when the line is grounded for telephone purposes.

Roy W. Eves.

Fishing Wires in Difficult Places.

When running wires in old houses, especially when fishing outlets in a porch ceiling that extends beyond the walls of the building, it is often difficult to hook the wire onto the fish hook because of obstructions. By connecting a bell and a battery in series with the wire to be fished and to the fish hook, the bell will ring when the hook makes contact with the wire, provided the wire to be fished is bared for a short distance from its free end. This arrangement prevents hooking on obstructions, and enables one man to do work that in many cases requires two men.

Robert Oster.

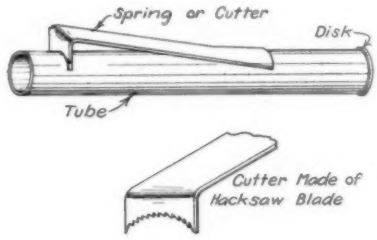
Cleaning Fixtures.

In many cases I have found when wiring a fixture with an iron stem that rust and dirt had collected on the inside. A quick and good way to clean it out is to take an old knockout from an outlet box, punch a small hole in the center and file it down until it will fit closely in the stem. Then it is a simple matter to string some bare wire through the stem and through the hole in the knockout. The latter can then be pulled through the stem and the dirt will be scraped out.

Melville Fischer.

Cutting Arc-Lamp Carbons.

An inexpensive arrangement for cutting arc-lamp carbons to length can be made by taking a piece of chandelier tubing of a diameter to easily slip over the carbons and about seven inches long. One end of this is closed by soldering on a disk of the same size as the tube. Near the other end, saw a slot in the tubing wide enough to take a piece of hacksaw blade, making the distance between disk and slot the desired length for the carbons. Heat and bend a piece of hacksaw blade, as shown in the illustration, and solder the end of it to the tubing, after teeth have been filed in the end.



Cutter for Arc-Lamp Carbons.

To use this cutter the carbon is placed in the tubing; the hacksaw blade is pressed down and the carbon turned around. It will break very easily where it has thus been scratched.

Battle Creek.

Making the Wires Tight.

In wiring old dwellings by taking up flooring I have found the best method of drawing the wires tight is as follows. When boring holes with brace and extension bit through the floor joists they are of course bored at an angle. The wires are threaded in, leaving the tubes on the wires between the joists. The wires are pulled up snug and fastened to knobs at each end, then when the tubes are pushed into place in their respective holes, the wires are drawn up as tight as a fiddle string.

Ernest C. Jones.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

Jurisdiction of the Commission. The Supreme Court has rendered a decision holding that the Railroad Commission did not have jurisdiction to refuse to allow the Oro Electric Corporation to operate in the city of Stockton. The Oro company held a franchise from the city granting it the right to furnish service within the city. The Commission held that the service could be furnished more economically by the Western States Company operating in the city exclusively, and refused in decisions issued April 29, and August 16, 1913, to allow the competitive service. The Oro company appealed from this decision. The court says that the people, voting for the law under which the Railroad Commission was created, believed that the cities would retain their powers of regulating the operations of public utilities until they chose to surrender them. The amendment allows the cities to decide whether they shall keep or relinquish such powers, and the courts cannot take away this right. The city of Stockton has not so delegated its powers to the state commission. The Court held that in denying a corporation holding a franchise from the city the right to exercise such franchise, the State Railroad Commission acted in excess of its authority and jurisdiction in Stockton. The Court also held that the cities have control of their utilities regardless of whether or not they were in operation when the Commission was created.

The Supreme Court has reversed the decision of the Commission in the case involving the Del Mar Water, Light & Power Company. The Commission had ordered the company to furnish a certain man with water service after the company had refused to do so on the ground that it was not a public utility but simply the incorporated water department of the South Coast Land Company. The Commission, from the company's articles of incorporation, defined it to be a public utility. The Court held that the Commission has no power to compel a corporation which owns property in private right and has not dedicated it to any public use, to apply it to a public use.

Changes in Public Utility Rates. The Commission has made a formal ruling to the effect that public utilities desiring to correct discriminatory rates may do so on their own initiative without authority from the Commission, providing that they do so by lowering a rate. If rates are to be raised to eliminate discrimination, the permission of the Commission must be secured. The rule was set forth in a decision rendered by the Commission in the case of the Pacific Telephone & Telegraph Company, which was found by the Board to have discriminated in rates for farm-line service in connection with the operation of its Modesto exchange. The rates varied between $3 and $7.20 per year, and the Commission gave the company 30 days in which to establish a uniform rate of $3 with the alternative of applying to the Commission for authority to enforce a higher rate.

DISTRICT OF COLUMBIA.

The Washington Railway & Electric Company was authorized by the Public Utilities Commission of the District of Columbia to issue bonds of the par value of $1,000,000. The proceeds are to be used for the retirement of the Company's bonds.

GEORGIA.

Power Over Contracts. A petition for an injunction against the Georgia Public Service Corporation has been filed in the Superior Court to restrain the company from abrogating any of the terms of written contracts for furnishing electric service. The Commission's decision in the Macon case, cited in the ELECTRIC REVIEW AND WESTERN ELECTRICIAN, of March 7, 1914, fixed new rates for electric service and ordered that the new rates be uniformly enforced disregarding the old contract rates which had been offered during a severe rate war in Macon. In appealing to the court, the petitioners allege that the Commission does not have jurisdiction over such contracts. It is also contended that the action of the light company in taking over the stock of the other public utility companies in Macon was in violation of certain provisions of the state constitution and it is asked that the competitive conditions be restored.

ILLINOIS.

Conference Ruling. The Commission held that under Section 16 of the Public Utilities Law, each public utility operating within the state must have an office in one of the cities, villages or incorporated towns in this state in which its property or some part thereof, is located, and that it shall keep in such office all its books, accounts, papers, records, and memoranda, pertaining to the business of the utility transacted within the state.

The Springfield Gas & Electric Company. The Commission has begun the investigation on the complaint of the city of Springfield asking that the company's rate for gas be reduced from $1.00, the present rate, to 70 cents. The case will be followed with considerable interest as it is the first important case involving public utility valuation and rate making to come before this Commission.

MARYLAND.

Extension of Line. The Commission held that the proposed extensions of the Curtis Bay line to Arundel Cave would be a "great convenience to the petitioners and others similarly situated" but that it would not be a "public necessity" of sufficient importance to justify the loss to the railway company. The company has an old franchise giving it the right to extend its lines in Anne Arundel County for 30 miles in any direction and the petitioners asked that the company be compelled either to build the extension to Arundel Cave or forfeit the franchise. The Commission issued an order dismissing the case.

NEW JERSEY.

The Public Service Electric Company has instituted certiorari proceedings in the Supreme Court to review an order of the Board of Public Utility commissioners. The Board ordered the company to comply with the terms of an ordinance of the city of Plainfield under which it agreed to furnish service to the municipal buildings without charge. (The opinion of the Commission was given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, April 11, 1914.) The company in its appeal to the court contends that the contract in question was abrogated by the Public Utilities Law and that the Board is without jurisdiction to make the order which would require the company to continue an illegal practice.

PENNSYLVANIA.

Filing Rate Schedules. The Public Service Commission has issued an order that all utility companies doing business in Pennsylvania must file at the office of the Commission by June 1, copies of all tariffs issued by them in effect on January 1. In addition there must be filed all supplements and amendments so that the Commission will have a record of all prices, rates, etc., for service rendered.

Street Lighting Contracts. The Commission has approved the contracts for street lighting of the Manor Electric Company in Manor, of the Venango Valley Electric Company in Sharon, and the Sharpsville Electric Company in Sharpsville.

WISCONSIN.

Stevens Point Lighting Company. The utility applied for a revision in rates and the Commission on its own motion made an investigation of the service of the company. The company was found to be delinquent in matters conforming to the service rules and regulations prescribed by the Commission. Certain improvements were made by the company and certain additional improvements were specified in the Commission's order.

The Commission reviewed the relation existing between the Stevens Point Lighting Company and the Stevens Point Power Company. The latter company generates by water power exclusively for the lighting company. The Commission found that the price per kilowatt-hour under this arrangement was about 1 cent per kilowatt-hour while under steam generation the cost would have been about 2.3 cents in cities of about the size of Stevens Point. This saving in expense the Commission points out, should be shared by the public and the company. An additional amount was accordingly added to the generation costs of the lighting company.

It was found that lower rates should be prescribed for general lighting and that higher rates are warranted for power service. New rates were ordered for lighting and power following the Commission's usual form of schedule. The rate for street arc lamps was reduced from $78 to $54 per year.

McGowan Water, Light & Power Company. The Commission ruled favorably upon the application of the company for authority to place in effect a minimum charge to be paid monthly by consumers. The application was for a minimum of $1.00 but the Commission decided that local conditions did not warrant a minimum charge in excess of 75 cents. The company was found to be losing money in both its water and light departments.

The Mattoon Telephone Company applied for authority to build a line from Mattoon into Phlox. The Commission dismissed the application, holding that where one company is already giving toll service between two localities, a certificate of convenience and necessity will not be issued to a second company to build a line between these points for the purpose of enabling subscribers along the proposed line to have connections with the villages at regular subscribers' rates.

The Commission stated that the company's subscribers at Mattoon can receive service to Phlox through the Antigo Telephone Company, the toll company, and that such subscribers have their remedy, in the matter of rates for such service, before the Commission in the form of a complaint involving the reasonableness of the Antigo company's toll charges.

Committees of Missouri Association Submit Reports to Public Utilities Commission.

The three committees on Depreciation, Historical Matters and Classification of Small Companies appointed by the Missouri Electric, Gas, Street Railway and Water Works Association at a meeting in St. Louis on April 1, reported to the Association on April 14 in the same city and submitted their reports to the Missouri Public Utilities Commission at Jefferson City on April 15. The meeting at Jefferson City was at the call of the Missouri Public Utilities Commission, which is endeavoring to formulate a uniform system of accounting for all public utilities in Missouri. The report of each committee was accepted by the Missouri Association but the Public Utilities Commission, while it thanked the Electric, Gas, Street Railway and Water Works Association for its initiative, did not look favorably on its recommendations.

The result of the hearing, which took place in the senate chamber, because of the unusually large attendance, was the appointment of a joint body to work out the problem of classification of public utilities and to hold frequent meetings for this purpose. P. J. Kealy, of the Kansas City Railway & Light Company, was appointed chairman of this joint committee. Other members are as follows: E. Gruhl, H. Wurdack, F. B. Saunders, J. C. Adams, R. C. Russum, J. M. Scott, H. H. Gansloser, W. J. Achelpohl and J. N. Chester. In addition to these men, the municipal light plants at St. Louis and Kansas City will have one representative each on the committee, the personnel of which was concluded by the appointment of J. C. McShane, statistician for the Missouri Public Utilities Commission.

Of the reports made to the Missouri Electric, Gas, Street Railway and Water Works Association and later to the public utilities commission, that of the Committee on Depreciation, of which P. J. Kealy is chairman, is regarded as of most importance. This committee's report considered the deduction of depreciation reserve from the fixed capital account and the seeming intention, as set forth in the tentative classification, to consider the depreciation reserve as a fund on which interest must be annually set aside. The Committee recommended that the Commission be petitioned to consider the depreciation reserve as a reserve account. This is done in the state of New York, the New York state commission, when first establishing a uniform system of accounts for public utility companies having taken the same position as the Missouri commission is now considering, but after several years' experience it now considers depreciation as a reserve account, and companies are not required to write down the plant account upon their books each year by the amount of the depreciation reserve. The Committee enumerated several objections to considering the depreciation reserve as a fund on which interest must be annually set aside. The adoption of this measure, it was claimed, would increase the cost of service to the rate payer as only a low rate of interest can be obtained on securities of immediate market value, and would be an impossible requirement considering the financial conditions of some companies. In concluding its report, the Committee asked to be continued until after it should be advised by the Commission as to its intentions in these matters.

In reporting on the tentative requirements of the Commission in relation to historical data, the Committee on Historical Data declared that a company should not be required to meet the expense necessary to furnish such historical data as would be of little or no value to the Commission. The report of the Committee on Classification of Small Companies went into considerable detail pointing out that some important items had been omitted from the tentative classification of the Commission. It was suggested that companies having gross earnings of less than $25,000 be considered as small companies under the classification.

While the matter in hand affected directly only utilities of Missouri, it created widespread interest and the meeting in Jefferson City was attended by many indirectly concerned.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 213.—Electric Motorcycle.—Is there on the market at the present time an electrically propelled motorcycle or quick-delivery car? If so please describe same briefly and give manufacturer's address.—A. J. L., Hazelton, Pa.

No. 215.—Suction Street Sweeper.—Has the use of electrically operated suction street sweepers ever been tried out by any street-railway company to keep its tracks free from dust and dirt? The kind I have in mind would be operated from the trolley line just like a snow sweeper, but instead of throwing the dirt over the rest of the street would suck it up into a dust compartment.—V. B., Milwaukee, Wis.

No. 217.—Telephone Generators.—Why will a 2,000-ohm telephone generator when turned 120 revolutions per minute make a 10-volt 15-watt Mazda lamp burn up to about two-thirds candlepower while it will not make a six-volt Mazda lamp of any candlepower that I have turn even red? It will also make the low of a 110-volt Hylo lamp burn up to and over candlepower.—C. M., East Las Vegas, N. M.

No. 218.—Panama Canal Locomotives.—What reasons were considered for adopting the very low potential of 220 volts for the towing locomotives for the Panama Canal? Why was three-phase current chosen instead of direct current, which has many advantages as long as high voltage was not to be employed? Why are two very heavy and costly copper "third" rails used as contact lines? Why is the rack-rail construction such a one as to take hold of the rack pinion?—A. G., Wilkinsburg, Pa.

Answers.

No. 200.—Electrically Operated Phonograph.—Is any phonograph on the market in which winding of the spring is automatically done by a silent electric motor whenever the spring tension gets down to a certain point? I believe several patents have been issued on electromagnetic release for a brake that stops the disk when the record has been played; has any device of this kind been applied to any phonograph on the market?—M. P. C., Jackson, Mich.

The writer has developed and has now in process of being patented a device which will wind a phonograph upon the touch of a button. This device can be attached to any phonograph and adjusted to any spring tension in a very short time. When a record has been placed on the machine, the operator, at the same time that he stops the machine, touches the button, and before he has had time to change the record, the phonograph is rewound ready for the next performance. The device is such that, when the spring is wound to the tension at which the device has been set to stop, the motor will not start again when the button is pressed. Only after the spring has unwound a bit will the motor start again when the button is pressed, and run only so long as is necessary to bring the spring back to the set maximum tension. Under this principle there is no need for having a high-class expensive silent motor. Our device avoids the two big difficulties which have heretofore interfered with the successful operation of phonographs with electrical motors, namely the effect of the noise and vibration as well as the fluctuation in the speed due to variation in the line voltage.—R. M., Milwaukee, Wis.

No. 204.—Highest Voltage.—What is the highest known voltage ever developed in any electrical apparatus?—M. L., Oak Park, Ill.

A 500-kilovolt-ampere transformer has been built by the General Electric Company designed for a high-tension voltage of 750,000 volts and is in present use for testing purposes at its Pittsfield Works. Although this transformer is built for 750,000 volts, approximately 1,000,000 volts has been measured across its highest tension terminals. This is believed to be the highest measured voltage ever developed in any single electrical apparatus. Several transformers of about 200-kilovolt-ampere capacity have been built for 500,000 volts and are in commercial use for insulator testing. It is proposed in one case to connect two of these in series on the high-tension side so as to get 1,000,000 volts.—H. C. C., New York, N. Y.

No. 214.—Allowable Load on Lighting Circuits.—On account of the practically universal use of tungsten lamps, would it not be advisable to alter the present rule in the National Electrical Code so as to allow the use of 750 watts on a circuit, which would allow three 250-watt, five 150-watt, seven 100-watt, twelve 60-watt, eighteen 40-watt, or thirty 25-watt tungsten lamps on each circuit? At the present time the Code's limit is 660 watts on a circuit, based on the use of 55-watt carbon lamps. Since the introduction of tungsten lamps it has been a matter of local interpretation of the individual inspectors regarding the number of lamps per circuit; in some localities three 250-watt lamps are allowed, in other localities two only can be placed on a circuit; the same applies to 150-watt lamps, some inspectors allowing four and others five, and yet all inspectors will pass twelve 60-watt tungsten lamps on a circuit. If this matter could be definitely settled it would do away with a great deal of argument and at the same time bring the Code up to date. The slight additional amount of current over six amperes will in no way affect the circuit wiring nor the question of danger from fuses, as it is quite universal to use the N. E. C. cartridge fuse which does not explode upon a short-circuit.—G. E. D., Newark, N. J.

The party asking this question is evidently not aware that the 1913 National Electrical Code has taken into consideration the almost universal use of tungsten lamps and a number of the rules have been changed to meet the requirements of these lamps. A higher amperage has not been allowed on a branch two-wire circuit as commonly used, due to the fact that this rule is for the protection of the rubber insulation of the small wires used in fixtures and for drop and extension cords. Rule 23*d* of the 1913 Code provides that no set of lamps, small motors, etc., requiring more than 660 watts, nor more than 16 sockets or receptacles, will be dependent upon one cutout. Previous to this only 12 sockets or receptacles were allowed on one branch circuit, this number being based upon the use of 55-watt carbon lamps while the new rule is based on the use of 40-watt tungsten lamps. The larger tungsten lamps can be installed under the same section where in the next paragraph it states that: "By special permission, in cases where wiring equal in size and insulation to No. 14 B. & S. gauge approved rubber-covered wire is carried direct into keyless sockets or receptacles, and where the location of sockets and receptacles is such as to render unlikely the attachment of flexible cords thereto, the circuits may be so arranged that not more than 1,320 watts (or 32 sockets or receptacles) will be dependent upon the final cutout." The large tungsten lamps can be installed under this latter rule which should reduce the cost of the installation considerably.—C. T. P., San Francisco, Cal.

I believe in doing away with the allowable wattage rating on circuits and keeping the outlets per circuit to a maximum of 12. Another method should be used to limit the maximum loading. The weakest part of the present practice is the use of the key socket; abolish the use of it, or limit the maximum fuse capacity to such a value that the key can break safely. The next weak point is the small fixture wire. Prohibit the use of heating appliances on lighting circuits where the device consumes more than 250 watts (except in special cases where permission is granted). If the above limits were set the safe current value would not be exceeded. If the present

types of Code fuse blocks were made in a greater number of the smaller sizes, say 5, 10, 15, 20, 25, and 30-ampere capacity, and fuses of the heavier type so dimensioned as not to fit any of the smaller blocks, much could be done to prevent the overloading of circuits. The number of outlets might then even be increased to 20. I would also require the use in every case of a double-pole switch, of a capacity rating sufficient to break the maximum possible current flow, with the largest fuse capable of being placed in the block in use.—H. E. W., Chicago, Ill.

No. 216.—Frosted Nitrogen-Filled Tungsten Lamps.—The new nitrogen-filled tungsten lamps produce an intense, concentrated light so that looking into the exposed lamp causes very harmful glare. Is frosting of the bulb recommended for reducing this difficulty, or does frosting cause the lamps to run too hot? What effect has frosting on the life and efficiency of these lamps?—D. A. T., Albany, N. Y.

The new high-candlepower Mazda lamps on account of their intense brilliancy should be used with diffusing glassware and, on account of the large amount of heat, should be used in fixtures that are properly ventilated. Frosting the bulb will not diffuse the light as well as diffusing glassware. Frosting these lamps has a tendency to make them run slightly hotter, which tends to shorten the life and blacken the lamps.—H. S., Harrison, N. J.

Nitrogen-filled lamps are at present manufactured with clear glass bulbs in all sizes; frosted lamps are not made of this type and frosting is not recommended. The glare may be relieved by an opal outer globe. The filament is concentrated in a series of closely wound spiral coils of drawn tungsten wire operating in nitrogen gas at high temperatures. Owing to this high temperature, it is recommended that lamps of 400 candlepower and above operate in special ventilated fixtures, and with outer globes to protect the lamp from moisture and atmospheric changes. The concentration of the filament produces intense brilliancy and glare unless some method is used to conceal the light source and distribute the light rays. This can be relieved in all sizes by the use of a properly designed opal diffusing globe. The actual mean hemispherical candlepower may be reduced by this globe some 15 or 20 per cent but the use of a concentric reflector above and a globe of opal prismatic glass surrounding the lamp will increase the useful candlepower, with a resultant increase in actual efficiency.—H. C. C., New York City.

A Transportation Record.

The Interborough Rapid Transit subway system in New York City has carried about 2,198,000,000 passengers in the last nine years without a fatal accident to a single passenger.

Nitrogen-Filled Tungsten Lamps To Be Used in Chicago Street Lighting.

Arrangements have practically been completed for an initial order for 2,000 nitrogen-filled tungsten lamps for use in the municipal street-lighting system of the city of Chicago. These lamps will be supplied in place of about 1,000 flaming-arc lamps, and are but part of the new equipment still to be provided under the amended contract between the Sanitary District of Chicago and the city, under which a total of 23,000 flaming-arc lamps or their equivalents are being installed. This contract and the municipal street-lighting system of Chicago in general were described by us in the issue of September 6, 1913.

The new nitrogen lamps will be 300-watt lamps, taking 20 amperes, although used on 10-ampere circuits. Each lamp will be equipped with an autotransformer or compensator to supply the lamp with the requisite current. It is expected that the lamps will give an average life of 1,350 hours. Each lamp will be housed in a casing practically the same as that now in use for the flaming-arc lamps; this will be so arranged that either flaming-arc or nitrogen lamps can be used in the housing, the condenser in the former case being displaced by the flat reflector. Surrounding the lamp itself will be a double prismatic reflector with the prisms on the inner surface of the hollow space between the two smooth outer surfaces. About this will be an opal diffusing globe of similar size and design to that now used in the flaming-arc lamps. The use of the prismatic reflector will be to give a very wide lateral distribution of the light; in fact, it is proposed to try out a special design of prismatic reflector to give what might be termed an eliptical distribution in a horizontal plane, with the major axis in the line of the street and the short axis at right angles to the direction of the street.

If these lamps give the performance that is expected, the probability is that the additional new lamps needed by the city to bring up the electric-lamp equipment to a total of 23,000 flaming-arc lamps, or their equivalent, under the old contract, and also the lamps under additional contracts for street lighting, will probably be supplied with the new types of nitrogen lamp.

Women's Club Recommends Improved Lighting in Salt Lake City Schools.

A special committee consisting of 22 prominent club women representing the Association of City Clubs, and headed by Mrs. B. F. Forbes, have been investigating conditions obtaining in Salt Lake City school buildings with reference to their health and sanitation, and have made numerous recommendations to the Board of Education with reference to the improvement of this feature of the public school system.

Among these recommendations is included the suggestion that many class rooms are inadequately lighted, and that the Board of Education either provide an adequate system of illumination for these rooms, or that they be abandoned for class purposes. They recommend that a vacuum-cleaner system be installed in the new high-school building and in all other school buildings as soon as needs will warrant. Furthermore, that more attention be paid to the ventilation of school buildings, and that adequate systems of forced ventilation be installed wherever necessary to correct this condition.

It is interesting to note that in most of the recommendations of this committee, electricity offers a solution of the difficulties encountered, which it is desired to remove.

Students' Electrical Show at Columbus, O.

Some half-dozen of the leading electrical concerns of Columbus, O., had displays at the exhibition of the student branch of the American Institute of Electrical Engineers held at Ohio State University, Columbus, O., for three days, beginning with April 16. Popular demonstrations for the purpose of educating the public in the use of electrical cooking devices and such things as are used in the home were a leading feature. Instruction was given householders in the reading of electric current meters. The faculty and students of the University's electrical department had the co-operation of the contractors in such a way as to make the exhibition highly valuable to the general public. Entertainment features were provided in the way of freak electrical demonstrations and the serving of cookery that had been prepared by electricity. The exhibition was open daily from noon until 11 o'clock at night. It was financed by the Institute, and no admission was charged visitors.

Electrical Equipment of East River Tube Being Changed.

Actual work has been begun on changing the trolley system of the Steinway tunnel under the East River, from Manhattan to Long Island City, to a third-rail system so as to permit the operation of railway trains. When the tunnel was completed nearly eight years ago it was designed only for light-weight overhead trolley cars. It will now be necessary to remove the trolley wires together with the present rail ballast and install a complete third rail system.

AMERICAN ELECTROCHEMICAL SOCIETY.

General Meeting, New York City, April 16-18.

The twenty-fifth general meeting of the American Electrochemical Society was held in New York City on the last three days of last week. The meeting was the most successful and best attended yet held by the Society, there being something like 300 members and guests in attendance. On Thursday, technical sessions were held both morning and afternoon at the Chemists' Building. An evening meeting followed by a smoker was also held. Friday was devoted entirely to a combined excursion and inspection trip, on which many stops were made at metallurgical and electrolytic plants in the lower part of New York City, Staten Island and adjacent points in New Jersey. The technical sessions were resumed on Saturday, when the meetings were held in Earl Hall, Columbia University.

The first session opened, with President E. F. Roeber in the chair, at 9:15 o'clock Thursday morning. Following a short business meeting, the technical program was opened up with a symposium devoted to power problems in electrochemistry.

Power for Electrochemical Industries.

The first paper presented was that by P. Sothman entitled "Efficiency of Power Transmission versus Utilization in Local Electrochemical Industries." Mr. Sothman's paper showed in what respects the transmission of electric power is applicable for electrical processes by setting forth an outline of the costs of power as generated by different classes of prime movers. The four principal prime movers are steam plants, water falls, gas-producer plants, and oil engines. While the latter two have not been used to any great extent for large installations, Mr. Sothman believes that these will soon come to play an important part in the production of power on a large scale, and constitute active competitors to steam and hydraulic powers. A table of costs was given showing the price per kilowatt-hour at which electrical energy may be generated by the four methods. This showed that the cost of power generated by the gas producer plant is less than that of the modern steam plant and within comparison of that for hydraulic power. A second table was given comparing the amounts of power used per employee in different industries. Paper mills and like industries utilize as much as 20 horsepower per employee. While no figures are available on chemical industries, it is believed that the power used per employee is still higher. On the other hand, some industries require even less than one horsepower per employee, and to these the cost of power at whatever rate is a comparatively unimportant item of production expense. The industries using large amounts of power must be in a position to obtain it at a very low rate, and under such conditions that they can have reasonable assurance that the power will not be diverted later to other industries which can afford to pay a higher rate.

Referring to the transmission of power, Mr. Sothman said that it is possible to transmit power at least as far as 500 miles in large quantities under the existing state of the art, although the losses in transmission will amount to a considerable percentage of the whole. There are several lines already in operation up to 240 miles in length, which are commercially economical. Whether or not power may be transmitted distances such as these is almost entirely dependent upon the power markets it is intended to reach. The majority of these lines are in locations where the market for power is high. In other locations, such as the East, where large coal fields are easily available, it would not be economical to transmit to such distances, the limit being in the neighborhood of 175 miles, for at this point modern steam plants would come into active competition with hydroelectric power. With the use of modern gas producers, burning coal costing $2 per ton, the economical transmission distance of water power is reduced to approximately 100 miles. The choice of voltages for high-tension transmission lines was discussed and voltage limitations shown. Cost of construction rises quite rapidly on very-high-voltage lines, and corona effects limit transmission voltages to 135,000 or 150,000 volts, unless large conductors and wide clearances are used. The suspension type insulator calls for considerable care in connection with line design. Costs of transmission lines were given based on typical types of construction for 12,000, 30,000, 60,000 and 110,000 volts.

In conclusion, Mr. Sothman said that the peat fields distributed all over the country are probably far more valuable to our power supply market than our water powers. Since the latter depend upon many features that are liable to interruption, we may find that the utilization of peat as a base material is worthy of serious consideration. We may reach a point where the use of peat will work very well in conjunction with hydroelectric power.

Charles P. Steinmetz then delivered an address entitled "Characteristics of Electrical Energy as Affecting Chemical Industries." Dr. Steinmetz opened his address by pointing out that industrial operations require materials, energy and labor. While the economical supply of energy is important for most industries, it is especially so for the chemical industries. In the supply of energy we have to rely upon nature's stores, of which only two are sufficiently large to come into serious consideration, that is, the chemical energy of fuel, mostly coal, and the hydraulic energy of water powers, made available by electrical transmission. Considered merely as the raw material, as bulk source of energy, the chemical energy of fuel is very much cheaper. Hydroelectric energy can compete with the chemical energy of fuel only in those cases where compensating advantages occur. There are two such cases. First, where electrical energy can accomplish chemical results which cannot be accomplished by the chemical energy of fuel; such processes are aluminum reduction, carbide production and fixation of nitrogen. Second, where the economic losses in efficiency and in cost of installation, and economic losses of making the chemical energy of fuel available by converting it to the form in which it is used, are such as to make the cost of the energy required by the industry when derived from the chemical energy of fuel higher than the electrical energy derived from hydraulic power. The most typical illustration of this is the mechanical energy supply. While the chemical energy of fuel costs about 0.1 of what the electrical energy from the water power costs, when we convert the chemical energy of fuel into mechanical energy by steam plant, considering the interest on the investment, the inefficiency of the thermodynamic process as a whole, from the chemical energy of the fuel to the mechanical energy at the flywheel, we find that almost always the cost of the mechanical energy derived from chemical energy of fuel is higher than that when derived from the electrical energy transmitted from the water power, other things being the same.

One of the characteristics which makes electrical energy specially suitable for chemical industries is the possibility of concentration to an almost unlimited energy density, which means that by electrical energy we can bring about chemical actions which cannot be brought about by the relatively low energy density available by combustion of fuel. In electric furnace processes we can reach temperatures two or more times as high as the highest temperature possible by the combustion of fuel, even with hot blasts and other auxiliaries. In those fields where a higher energy density is required electrical energy stands without a rival, irrespective of the cost, and the economy of energy supply merely determines the utility of the product in the industry.

The second characteristic of electrical energy is its control. We can control it very much more closely than the chemical energy of fuel, produced by chemical combustion. We can produce electrical energy without surrounding foreign materials which may enter as contamination. Therefore, electrical energy finds an application in producing chemical action, or other industrial processes, where a very close control of the energy is called for, and where the exclusion of contamination by foreign materials, which is practically unavoidable when fuel is used as the source of energy, can be insured. Another characteristic that electrical energy possesses is its ease and economy of transmission to great distances and its economical distribution, but its predominating advantage is its economical efficiency of conversion into others forms of energy.

There is, however, one characteristic of electrical energy which is a very serious disadvantage, and that is that electrical energy cannot be economically stored on a gigantic scale, but must be consumed at the same rate at which it is produced from other forms of energy. This makes the cost of electric energy dependent on the rate of its consumption, in the same manner as the cost of energy is dependent on the rate of its production. The cost of electrical energy generated in the same big power station may vary in a range of more than 1 to 200; that is, power may be sold economically and profitably at one-half cent, or less, per kilowatt-hour, while power generated at the few hours of the annual peak of the load may cost the station more than one dollar per kilowatt-hour. Dr. Steinmetz analyzed the cost of electrical energy production, showing the great importance of proper consideration of fixed charges of the plant. This is particularly true of hydroelectric plants. The station load-factor dominates the cost of energy production.

This imposes the requirement that to secure electrical energy at the lowest possible cost for chemical work it must be used at constant load and continuously day and night throughout the entire year, in other words, at unity load-factor at the consumer's premises. This emphasizes continuity and maximum demand. In electric-furnace work a reactance can be used to intentionally limit the maximum demand. While this would lower the power-factor, this is of less importance in most cases than to exceed a certain maximum demand, because poor power-factor can be corrected by synchronous condensers at relatively less cost than additional generating capacity can be secured to carry peak loads.

As most water powers are subject to limitation of output by low flow of water due to periodic drought, any industry that can afford to shut down entirely or at least partly for several weeks or even months during the drought can reduce the cost of its electrical energy supply. This means that conditions may require an annual shutdown, even with employees receiving full pay, to produce more economical operation than absolute continuous operation. Another item in reduction of power cost is the possibility of sudden shutdown, from a minute or so to possibly several hours, on account of failure of transmission lines. This eliminates the need for a steam reserve plant. The very lowest rate for power is possible to those industries that can utilize intermittent and distinctively off-peak power in proportion that it will fill the valley in the station's load curve and bring the station load-factor nearly to unity. The rate for such a load should be considerably lower than for one taking continuous power throughout the year. If electrochemists can build up such a load, they will get the electric power at the very lowest rates.

The paper entitled "Some Economies in the Use of Electric Furnaces" was then presented by F. A. J. FitzGerald. This paper pointed out the general direction in which the quest for economy should go and gave a warning about certain ideals which are apt to be exaggerated with uneconomical results. The typical power contract emphasizes that the most important point to be kept in view is the use of 100 per cent of the power 24 hours every day in the year. The desire for continuous processes is apt to be harmful, due to exaggeration of its importance. This has retarded the development of processes for the utilization of off-peak power. Such development has encouraging possibilities, but this problem should be taken up by those having power to sell rather than those using the power. Methods for securing suitable regulation of the current supply usually pay for themselves, because they give 100-per-cent load-factor. Power-factor is not really a troublesome problem, but where it becomes serious the use of synchronous condensers is desirable. It is possible to provide some type of furnace to absorb any power which might otherwise be wasted for one cause or another.

A paper was then presented entitled "Electric Furnace Regulation by Electric Furnace Regulators," by Robert Turnbull. Following this there was a paper entitled "Power for Electric Furnace Work," by W. S. Horry. The latter pointed out that hydroelectric power cannot produce all the energy needed by the increasing use of electric furnaces, and that coal will have to be utilized more and more. Three other papers were presented by title only, since they had been formerly presented at meetings of the New York Section of the Society. These papers were as follows: two papers by L. Addicks and H. E. Longwell entitled "The Power Problem in the Electrolytic Deposition of Metals;" a paper by F. D. Newbury entitled "Sources of Direct Current for Electrochemical Processes."

After all these papers had been presented a general discussion followed. Robert Turnbull asked what should be paid for off-peak power in comparison with power used continuously 24 hours per day. M. Petinot referred to the Thury automatic furnace regulator, and said its operation was as nearly perfect as could be desired. It was possible to secure a regulation of load-factor as high as 97 or 98 per cent by the use of this regulator. F. A. Lidbury stated that the different speakers had taken up the subject from their own points of view, and the papers showed that the point of view is an important factor in the consideration of any individual power problem. All speakers had shown, further, how complicated the consideration of their own particular phases of that problem may be in the majority of cases. This, of course, has something to do with the very varied nature of electrochemical operations. This varied nature is a somewhat startling one, in certain respects, in respect to size, the relative importance of power costs, and the importance of other considerations that may enter into the problem. The matter is somewhat complicated in regard to the electrical installation for electrochemical plants by the tendency of the electrical engineer to shove in all the electrical stuff he can possibly sell to the poor electrochemist. C. A. Hansen called attention to the fact that in general in furnaces having an arc, such as the steel furnace, the ferrosilicon furnace, and the calcium-carbide furnace that low loads mean a considerable wave distortion. As the current increases the wave distortion becomes less and less important, and when commercial energy densities are reached the wave distortion is really not serious.

C. P. Steinmetz said that wave distortion had been studied very thoroughly 20 years ago in the case of the series arc-lighting system. The effect of reactance on wave-shape distortion was then definitely observed. The best that can be said of the most desirable form of wave-shape distortion in the electric furnace is to get rid of it as soon as possible. The most important factor in reducing wave-shape distortion is reactance. If you lower the power-factor

by reactance, you lower the wave-shape distortion and thereby eliminate the reduction of power-factor due to wave shape. That means that where attempts are made to get as high power-factor as possible by cutting down all the reactance in the furnace the results have very often been disappointing. In his opinion the mistake made in most furnace operations is to attempt to get a low reactance. He did not think it good practice to attempt to operate at less than 80 to 85 per cent power-factor as calculated by the reactance of the system.

P. M. Lincoln said that the power-factor as calculated from the oscillograph record is a truer power-factor than the one measured by the power-factor meter. If the current wave is of the same shape as the voltage wave, the power-factor meter gives the true power-factor, but if the current wave and the voltage wave are not of the same shape, the power-factor meter does not give the true power-factor, and the latter must be determined in some other way. Wherever there is an arc present, the current wave is not the same as the voltage wave. The arc induces electromotive force in the circuit, so that the current wave departs very considerably from the voltage wave that produces the current. Mr. Lincoln referred to some of the ideal costs of power as mentioned in some of the papers. He said such costs could be realized only by the use of the very largest amounts of power under the very highest load-factors. If anyone was willing to make a contract with a power company for a matter, say, of 50,000 kilowatts, and guarantee a load-factor of 100, for 24-hour power, 365 days a year, and will guarantee that the load will remain on the power house for the next 20 years, it might be possible to get power at the ideal figures referred to in some of the papers.

Mr. Sothman thought it was agreed that the question of power is one of the most important in the electrochemical industry. He knew of contracts for power where the basic rate was $28.50 for power 24 hours a day for 365 days a year. If the consumer will waive the 80-per-cent power-factor, during the four winter months in the year, for one and one-half hours per day, that power could be had for $24, which is a reduction on the total power bill of about 22 per cent. Other contracts have been made where the reduction was as high as 34 per cent, if it was off-peak power. If the amount of power per employee is relatively very large, and of considerable value in the cost of production, it pays to buy off-peak power. If there are ten men working on a certain process and 1,000 horsepower is being used, and off-peak power can be purchased 25 per cent cheaper, it would be more economical to buy the off-peak power, and lay the men off for an hour or two, provided the process is not in any way interfered with as to the final results.

Carl Hering remarked that it is difficult to convince the power stations that it is to their interest to sell valley power quite cheaply. They do not seem to realize that, and their general rule seems to be the rule which exists in so many other busnesses and that is to charge all the traffic will bear.

The afternoon session opened with an illustrated lecture by Dr. W. D. Bancroft entitled "Electrolytic Flames." Some startling results were produced in this demonstration.

Electric Furnaces.

A paper was then presented by C. A. Hansen entitled "Electric Steel Castings." This paper described the results obtained with a two-ton three-phase arc furnace in a modern foundry at Easton, Pa. This furnace has been operating since the summer of 1911. It is supplied through step-down transformers with a furnace voltage of 85. The cost of the melted metal from the electric furnace was found to be less than one-half that with an old crucible furnace formerly used, the oil used for the latter being figured at 2.5 cents per gallon; since that time an advance in the price of oil has given still a greater margin of advantage to the electric furnace. Auxiliary fuel burning apparatus for the purpose of heating the furnace and charge to a good red heat by means of oil burners before the electric current is turned on was found to increase the cost about $1.00 per ton over all-electric heating. It was not found particularly advantageous to keep the furnace hot over night. Although continuous day and night operation of the electric furnace produces from 10 to 15 per cent saving over intermittent operation, the lower efficiency of the night shift is usually not taken into account. The furnace is operated on the one-heat per day basis and it requires from 7 to 7.5 hours to turn out its charge from the cold furnace; power consumption averages 1,050 kilowatt-hours per ton of steel. The load curve of the furnace has been found to be quite smooth and of higher power-factor than that of a load of similar magnitude in the machine shops of the foundry company.

A paper entitled "Electric Furnaces for Steel Making," was presented by E. B. Clarke. The paper discusses first the comparative value of the electric furnace compared with other types of furnace for producing or refining steel. The electric furnace will produce steel of the same degree of purity as the crucible furnace and since refining can also be carried on at the same time, it is possible with the electric furnace to use less pure materials. Mr. Clarke also compared the electric with the small Bessemer converter and with the open-hearth furnace, his conclusions being that for the alloying of steels the electric furnace offers nothing that the crucible furnace does not; for the production of very hot steel it offers nothing that the Bessemer converter does not, and from the metallurgical standpoint it offers nothing that the open-hearth furnace does not. However, it combines in itself certain advantages of all three of the other processes mentioned. Aside from the element of cheap power, which has sometimes been exaggerated, other factors of importance must be considered.

Henry D. Hibbard said that the increased cost when oil was used for preheating the electric furnace, as described by Mr. Hansen, and bringing it to redness, raised the question as to whether the electric current actually used was paid for, or whether it was paid for by the time it was available whether used or not. It seemed as if the economical arrangement would be to have two furnaces, or multiples of two, each equipped for oil heating and with one source of electricity. Then the current would be used continuously, that is, for the latter half of each heat, which would greatly diminish the current cost. With one furnace and the current used but half the time the cost of keeping the generator idle but ready to run is a very large part of that when it is actually running.

Ernest P. Humbert said he thought Mr. Clarke should tell the prospective user of an electric furnace wherein the statements of the men exploiting electric furnaces have differed from what he has found in practice. In his experience with the Heroult furnace, covering some 60 furnaces in the United States, France, Sweden, England and Canada, the furnaces have quite generally borne out the claims made by Dr. Heroult and his associates. One would infer from Mr. Clarke's statement that there was really not much difference between the electric furnace, the crucible furnace, the open-hearth furnace, or the Tropenas converter, as regards results. The electric furnace has one characteristic which he believed appealed more strongly to the metallurgist than any characteristic of any other process of making steel. This was that in the arc furnace there is a strong reducing action due to the exclusion from the melting chamber of the atmospheric

air, and the fact that carbon, which is one of the strongest reducing agents, is used in connection with the slag. This action is so striking that not only is calcium carbide normally present in the slag, but such elements as silicon, manganese, vanadium, tungsten, etc., are readily reduced from their oxides in the slag to the metallic condition in the bath.

Karl G. Frank said he wanted to emphasize that apparently in Germany the experience with the electric steel furnace has been more satisfactory than in the United States. In Germany in the year 1912 about 75,000 tons of electric steel was produced, and in the year 1913 about 100,000 tons, a very large percentage of which had been used for making steel castings. About 38 to 40 per cent in Austria-Hungary was made in the induction furnace. He believed if the electric steel manufacturers would go more thoroughly into the problem in this country the results would be more satisfactory.

Henry Hess declared that the statement that the roof of the Stassano furnace was short-lived was incorrect. He had a Stassano furnace in operation for several months and the roof had not shown any signs of distress when it was necessary to reline the basin or the side walls.

Joseph W. Richards said that a little study of the question would enable one to replace the silica roof with a basic roof, or a more refractory product, such as aluminum nitrite, so as to overcome the difficulties of the silica and its fluxing. He agreed with Dr. Frank that European practice in electric furnace work, for some reason difficult to understand, is not reproduced in this country with the same patience and same mastery of details as is accomplished abroad.

E. L. Crosby stated that he did not think the central stations generally were asleep as to the opportunities in the electrometallurgical and electrochemical fields. The Detroit Edison Company is not. The only difficulty in Detroit is that no one had been found who will come in and for a specified sum sell a man a furnace. The company had made a rate on electric furnace work of three-fourths cent or less.

Wm. D. Mainwaring said it was necessary to mix steel properly and the time factor must be taken into consideration. He had about 15 years' experience in steel making, which included about every type of furnace made, and he had seen some of the poorest steel made in electric furnaces and had seen some of the best made in that furnace. It is necessary to work steel right in all furnaces.

E. F. Cone called attention to the point that if you compare the electric furnace for steel castings with any other method of making steel castings consideration should be given to the refining power of the electric furnace as compared with any other furnace for making steel castings, whether open-hearth, or the crucible, or the converter. It reduces the sulphur and also makes a quality of metal which, so far as composition is concerned, is way ahead of anything to be obtained by other processes.

The afternoon meeting was concluded with the presentation by title of three papers. These were: "Improvements in the Metallurgy of Zinc," by G. C. Stone; "Electric Zinc Smelting," by W. R. Ingalls; "Advantages of Southeastern Alaska for Hydro-electrochemical Industries," by W. P. Lass.

The evening meeting was opened by the delivery of the annual presidential address by E. F. Roeber. This was entitled "Some Economic and Esthetic Aspects of Electrochemistry." Dr. Roeber's discussion was based first on the well known classification of Knies of economic values into place value, time value, and form value. The products of electrochemical industries have always high form value, and a long series of these products has also place value and time value, due to the fact that they have a very high energy content. By transporting electrochemical products to some other place where their energy content may be needed, they get place value. By getting the energy content out of them when it is needed they get time value. This is the foundation of "chemical power transmission." It differs from electric power transmission in two essentials. It is not bound to fixed route, it needs no line wires, as electrochemical products can be transported anywhere by the ordinary transportation facilities, and it is not bound in its utilization to a fixed time.

The electrochemical industries affect modern civilization in its most various phases. What was waste before, what was nuisance, becomes valuable; and in chemical power transmission electrochemistry has brought into modern civilization an absolutely new element by which what is now waste power is being scattered all over the world, to build up industries, to further agriculture with fertilizers, to aid public health with bleaching powder and to affect civilization in general in its most heterogeneous aspects.

Taking the esthetic side of the subject, Dr. Roeber concentrated his remarks on the subject that is uppermost in this connection in the minds of American electrochemists—the question of the power development of Niagara Falls. The beauty of Niagara Falls, like all beauty, is subjective in the onlooker. If we stand as modern men at the Falls with a free attitude of mind, we don't see simply water; we see power. We see the possibilities of using this power for electric power transmission for lighting, traction and industrial purposes on a wider area. We see the even greater possibility of storing this power in electrochemical products and utilizing them all over the land in all walks of life. If we look at the Falls with this attitude of mind, which is the natural one for modern men, all of the unutilized water appeals to us as waste.

At the two sessions on Saturday a large number of papers were presented, but there was relatively little discussion. These papers were as follows: "Progress in Leaching and Electrolytic Treatment of Copper Ores in South America," by E. A. C. Smith; "Hydroelectric Treatment of Copper Ores," by R. R. Goodrich; "Leaching of Copper Tailings," by R. Gahl; "Metal Inventory in an Electrolytic Copper Refinery," by R. W. Deacon; "Electrolytic Zinc," by J. W. Richards; "Addition Agents in the Deposition of Zinc From a Solution of Zinc Sulphate," by O. P. Watts and A. C. Shape; "Electrodeposition of Cadmium," by F. C. Mathers and H. M. Marble; "Electrodeposition of Nickel," by C. W. Bennett, H. C. Kenny and R. P. Dugliss; "Electrolytic Deposition of Brass on a Rotating Cathode," by C. W. Bennett and A. W. Davison; "A New Method for the Determination of Free Cyanide in Electroplating Solutions," by G. E. F. Lundell; "Electric Conduction at High Temperatures and Methods of Measurement," by E. F. Northrup; "Laboratory Notes on Some Electrical properties of Silver Sulphide," by F. A. J. FitzGerald; "Polarization Single Potentials," by C. N. Hitchcock; "New Cell Arrangements for Direct Determination of the Free Energy," by R. Beutner; "A New Railway Track Cell," by E. L. Marshall; "Experiments on White Lead," by R. S. Owens; "A Microscopic Study of Electrolytic Iron," by O. W. Storey; "The Effect of Addition Agents in the Electrodeposition of Iron," by O. P. Watts and M. H. Li.

Election of Officers.

At the business meeting held on Thursday morning, announcement of the election of officers was made. The successful candidates were F. A. Lidbury, Niagara Falls, N. Y., president; Carl Hering, W. D. Bancroft, William Brady, vice-presidents; Howard C. Parmelee, W. R. Whiting, C. G. Fink, managers; P. G. Salom, treasurer; Joseph W. Richards, secretary.

LETTER TO THE EDITOR.

Load Curves.

To the Editor:

It is often desirable to compare the "load curves" of one public utility with those of another, although the comparison is not always satisfactory because the various public utilities use the "load curve" to represent different kinds of loads. This difficulty would be obviated to a great extent by using the "production curve" and the "consumption curve" defined in the following:

The production curve is derived by plotting the amount of service or commodity produced, at the place of production, as ordinate, and the hour or date as abscissa.

The consumption curve is derived by plotting the amount of service or commodity consumed, at the place of consumption, as ordinate, and the hour or date as abscissa.

From the above definitions it can readily be seen that there may be two consumption curves, one for the individual consumer and the other for the supply plant. The second is the sum of all the individual consumer's consumption curves. This curve may or may not correspond to the production curve of the supply system.

In the case of a water-supply system which pumps water at a nearly uniform rate into an ample storage reservoir from which the consumers draw it as needed, the production curve will be almost a straight line extending over the whole of the period of time, and the consumption curve will have valleys and peaks of varying magnitudes. But a water-supply system that pumps the water as consumed will have a production curve that is similar to its consumption curve, disregarding leakage of the distributing system.

A system supplying artificial gas, on account of its ample storage capacity and method of manufacture, has as nearly uniform a production curve as the owners may think most profitable in the operation of the plant, while its consumption curve will have valleys and peaks. But a system supplying natural gas that regulates the pressure on the distributing system by means of pumps has a consumption curve similar to the production curve except for losses.

In the case of the telephone, street railway and electrical industries the consumption curve is always very similar to the production curve of the supply system, because these three public utilities have no efficient means of storing the service.

The difference between the integrated production curve and the integrated consumption curve is the sum total of the various losses occurring during that period.

L. C. TOMLINSON.

Atlantic, Mass., April 15, 1914.

Jovian Activities at Columbus, O.

Columbus, O., Jovians had an active day on April 17. At noon they met for luncheon at the Virginia Hotel, with a fine attendance, where they were addressed by John Kelly, secretary of the Columbus Chamber of Commerce. This was preliminary to taking part in Jovian night at the electrical exhibition in progress during several days at Robinson Hall, Ohio State University. The matter of attendance on this particular evening had been worked up vigorously, with the result that some 300 local electrical men were present, many of them with their wives or lady friends. There were no formalities, the time being spent in viewing the exhibits and witnessing the demonstrations in the adjoining auditorium.

A booth was maintained at the hall by the Jovians during the entire exhibition. Following were among concerns taking part in the affair: Avery-Loeb Electric Company, Erner-Hopkins Electric Company, McKeever Electric Company, National Cash Register Company, Sackett Mine Supply Company, Columbus Railway, Power & Light Company, Haynes Automobile Company, Dictating Machine Company, Brashear Motor Car Company, Haynes Motor Car Company, Lincoln Electric Company, Jeffrey Manufacturing Company, Landerferry & Clark Company, Hotpoint Electric Heating Company, Automatic Telephone Company, Diehl Manufacturing Company, Banner Electric Company, Westinghouse Electric & Manufacturing Company, General Electric Company, Judd Laundry Machine Company, Western Electric Company, American Telephone & Telegraph Company, Central Union Telephone Company, Simplex Electric Company, American Electrical Heater Company, Conlon Electric Washer Company, Premium Vacuum Cleaner Company, Lindstrom-Smith Company, Macbeth-Evans Glass Company, Eclipse Machine Company, Dayton Fan & Motor Company, Frantz Electric Suction Cleaner Company, and Invincible Manufacturing Company.

Meeting of Duquesne Electric Light Section.

The Duquesne Light Company Section of the National Electric Light Association, held a brilliant banquet recently in Kaufmann's banquet hall, Duquesne, Pa. An elaborate menu was served and this was followed by a general electrical discussion. President E. C. Stone, of the section, presided and introduced the speakers. A stereopticon was used to illustrate the talks on electrical equipment, which were delivered by F. E. Harper, who analyzed the installation of the electrical system in the Kaufmann store of that city; W. I. Bickford, who took part in the installation of the system, and E. D. Dreyfus, of the West Penn. Power Company, who spoke on "Electrical Service, Prospective and Retrospective."

Civil Service Examinations.

The United States Civil Service Commission announces open competitive examinations at the usual places on May 20 for junior electrical engineer (male) and junior railway signal engineer (male). An examination will also be held directly after May 11 for associate physicist; competitors for this position will not be assembled for examination but will be rated on general education and scientific training, practical experience and fitness, and publications or thesis. An educational training equivalent to that required for an engineering degree from an institution of recognized standing, and at least three years' experience in the construction and operation of furnaces, kilns, etc., in the manufacture of fireproof structural materials (clay products, cement, etc.), as well as in practical pyrometry, or three years experience in work relating to the testing and use of structural materials, the fire-resisting properties of structural materials, fireproof building construction, building codes, etc., are prerequisites for consideration for this position. If a thesis is submitted it must represent the results of original work on the part of the applicant on some phase of the subjects named above. Statements as to training, experience and fitness are accepted, subject to verification. Applicants must be between 30 and 40 years in age and should secure application Form 304. From the register of eligibles appointments will be made to fill vacancies in the Bureau of Standards, Pittsburgh, Pa., at a salary ranging from $2,200 to $2,700 per year; and in Washington, D. C., at a salary ranging from $2,200 to $3,500 per year.

Applicants for the positions of junior railway signal engineer and junior electrical engineer must have had three years' practical experience in railway engineering and must be younger than 36 years of age. Appointments will be made to fill vacancies as they may occur in this position in the Interstate Commerce Commission at salaries ranging from $1,080 to $1,500 per annum and will be principally for duty in the field. Application Form 2039 should be secured.

SOME NOTES REGARDING SWITCHBOARD DESIGN AND CONSTRUCTION.

By S. W. Mauger.

It is gratifying to one who has spent many years on switchboard design to note the increased respect paid by electrical men in general to the once almost despised switchboard. Not only are the manufacturers of switchboards paying more attention to the details as well as the general design, but the users of switchboards are more critical, appreciating the importance of a properly designed and constructed switchboard.

It is understood nowadays that the switchboard means more than a few panels on which are mounted switches and instruments, and that it covers the whole system of connections with its layout of switching apparatus, busbars, etc.

Not only have great strides been made in connection with high-tension installations, but even the low-tension switchboards show a decided improvement over those built several years ago.

It is the writer's intention in the following notes to point out to prospective purchasers and designers of switchboards the important features that should have careful consideration. The low-tension switchboards will be mentioned first and the main features that are essential to a good low-tension board, enumerated as follows:

(1) The apparatus on front of board should be mounted to give the best results from an operating standpoint and not merely with regard to appearance. For instance, circuit-breakers should be so mounted that an arc from them will not involve the switchboard attendant or devices mounted near the circuit-breakers.

(2) The back of board should be laid out so that all parts which need periodical or occasional attention will

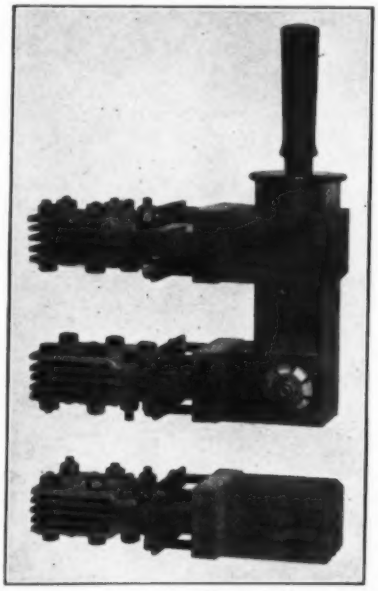


Fig. 1.—Switch With Laminated Studs.

be accessible. This would include fuses for instrument and main circuits and nuts and bolts which affect current-carrying parts.

(3) The minimum number of bolted and sweated joints should be used. Where complicated bends in connection bars are required, sweated and bolted joints have often been resorted to to facilitate manufacture, but this is not now necessary for those having the necessary machinery for making workmanlike twists and edgewise bends.

(4) The above principle should also apply to the switches and other current-carrying parts, and in comparing switchboards, should be carefully considered. This is especially true of switch and circuit-breaker studs which for proper operation should be integral with the contact blocks, that is, each block and its stud should be formed out of one piece of metal.

(5) In the case of large capacities, laminated terminal bars instead of round studs give the best results, in that they allow simpler design of connections, greater accessibility for tightening joints, and, therefore, less occasion for trouble from heating. (See Fig. 1.)

(6) Attention must be given in design toward making it easy for men installing a switchboard to connect the generator and feeder cables to the switchboard. This is a point that is sometimes overlooked in large direct-current and alternating-current low-voltage switchboards and has a large influence on the ultimate cost of the installed switchboard. The price quoted f. o. b. manufacturers' works is not the only thing to consider. See Figs. 2 to 9 inclusive, showing good types of boards.

In designing the back of direct-current switchboards better results can often be obtained by mounting the bus of one polarity near the top of board and the bus of the other polarity say two to four feet from floor, according to layout. This gives greater accessibility to terminals and studs with the usual arrangement of switches and circuit-breakers. It also has the advan-

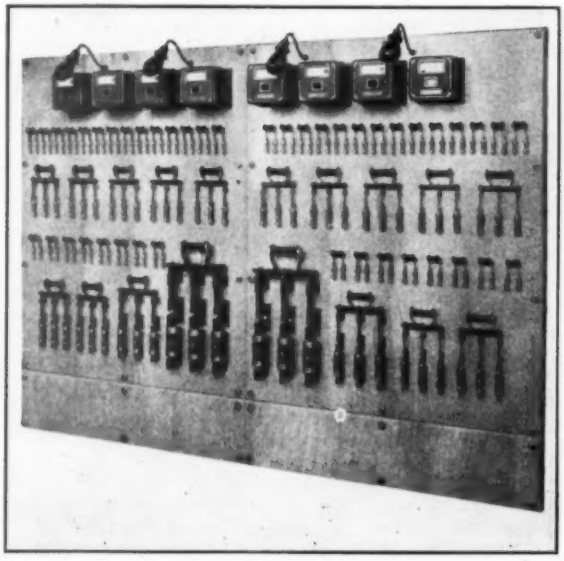


Fig. 2.—Switchboard for Small Office Building.

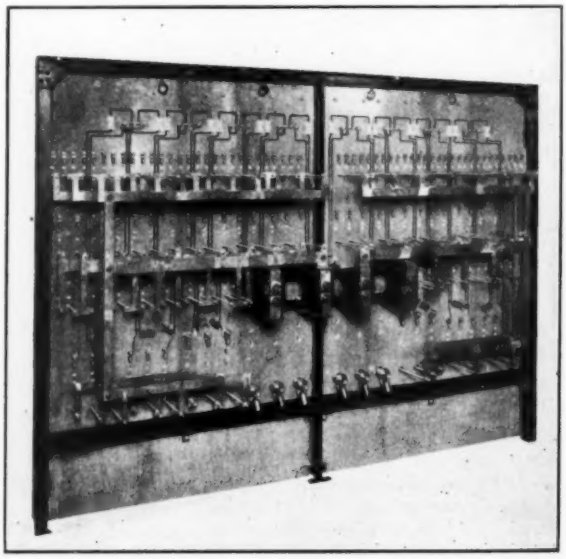


Fig. 3.—Rear View of Same Board.

tage of giving less liability to accidental short-circuits between buses. See Fig. 10.

On alternating-current low-tension boards involving heavy current, say 2,500 amperes and above, especially at 60 cycles, it is not feasible to follow the ordinary direct-current practice regarding arrangement, mounting and current density of bars, on account of the heating that would result. It is necessary to go to much lower densities, depending upon ventilation. Iron work, including bolts and supports in close proximity to bars, will become hot, the safe distance depending upon amount of current carried in the bars. There is an erroneous idea that the iron will not be overheated when near bars carrying heavy alternating current unless the iron forms a complete magnetic ring. This is not so, as anyone can prove by hanging an iron bolt in a very strong field caused by alternating current.

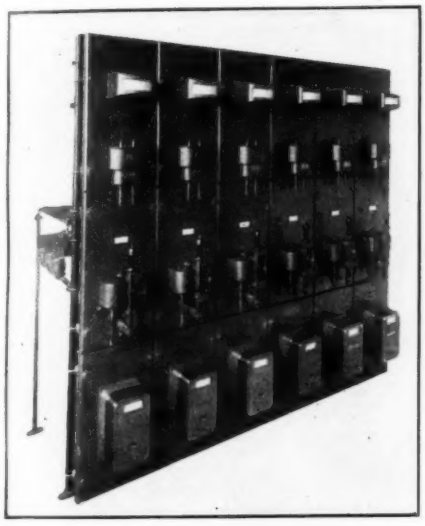


Fig. 4.—Moderate Size of 600-Volt Alternating-Current Switchboard.

When considering a switchboard involving very heavy current, which is now quite common for 250 and 600 volt direct current and 600 volts alternating current, remote-controlled switches and circuit-breakers will usually be found to work out advantageously from a standpoint of first cost as well as operation. With remote-controlled devices the control switchboard can be made more compact, and the main switches and circuit-breakers can be located to obtain the greatest economy in cable, as well as station design. See Fig. 11.

Another point to consider when dealing with heavy currents is the matter of stray-field effects on instruments. Some instruments are more susceptible than others, and some are affected differently from others, that is, some are affected by a field from a vertical bar more than from a horizontal bar and vice versa. Most permanent-magnet instruments are more or less affected. It is not, of course, merely the normal current that is to be considered, but the current developed on overloads or short-circuits, which when bars are in a certain relation to the instruments permanently affect the accuracy of an instrument. Knowing this, it is possible to select the most suitable instrument and design the connection and busbars to give the minimum trouble from stray fields. The use of remote-controlled switches obviates all such trouble, the main current-carrying parts being sufficiently distant from the instruments.

High voltage direct-current railways are now becoming quite common and designs for 1,200-volt switchboards are standardized and a few 2,400-volt boards have been built. Fig. 12 shows a 1,200-volt panel. In general, 600-volt railway practice has been followed, except that the circuit-breaker and switch are mounted higher and are operated by handles near the bottom of the panel, through levers and bell cranks. The ammeter cover is insulated so as to be safe to touch. For 2,400 volts it seemed advisable after tests to go a step further and mount the circuit-breaker and switch back three or four feet from the panels and provide the circuit-breaker with powerful magnetic-blowout shutes. Otherwise the design of the 2,400-volt panels follows that of the 1,200-volt panels.

When it comes to alternating-current switchboards for 2,300 volts and over, the considerations brought out in the foregoing apply in more or less degree, but the question of insulation and safety must be more carefully considered. A number of disastrous accidents to life and apparatus have resulted from a false idea of economy in first cost or by lack of experience as to what is adequate. Sometimes the practical man of a power company, having had some sad experiences, has asked for an appropriation to cover a suitable switchboard equipment, but the directors ever on the alert to keep down expenses have made the practical man get along with something less suitable. This happily is now mostly a matter of history. Then again, a purchaser is sometimes misled by exaggerated statements.

There is no need of going astray if the subject is gone into cautiously and with the firm conviction that the switchboard should be the strongest link in the chain of system operation. On this last point an illustration of poor engineering would be a case of, say, a 11,000-volt overhead system having insulators that arc over at 50,000 volts with switching apparatus controlling the circuits arcing over at 25,000 volts. In the case of heavy voltage surge, there will be a "spill-over" at the weakest point. Another illustration would be where a generator could deliver without dangerous heating, 1,000 amperes and the switch controlling the generator could carry safely only 800 amperes. The normal rating of generator and switch may be the same, but the generator, while not being able to continuously carry more than the switch, may be able to carry, for one hour, more than the switch. A switch may reach its ultimate temperature in one hour or less, whereas a generator takes a much longer time.

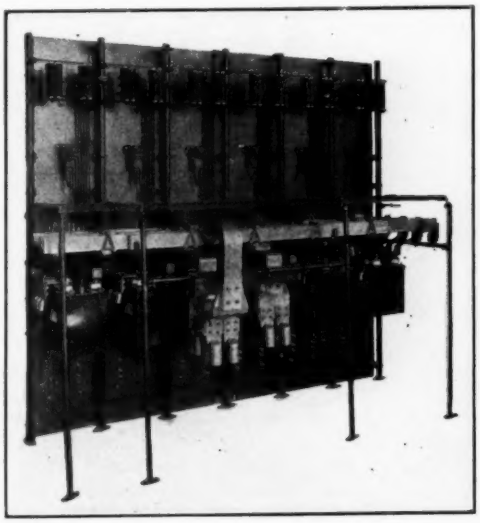


Fig. 5.—Rear View of Same Board. Note protecting screen over busbars and convenient location of cable terminals.

Rupturing capacity is another question that engineers are beginning to talk about, but comparatively few have an adequate perception of what it means or how to apply the term. It has been usually defined to mean the bus capacity to which a circuit-breaker is connected and is supposed to give the safe limit for the use of the circuit-breaker for the protection of machines and circuits under short-circuit conditions, the bus capacity being the kilowatt-amperes (including the one or two-hour overloads) supplied to the buses. It is obviously impossible to give a definite "rupturing capacity"

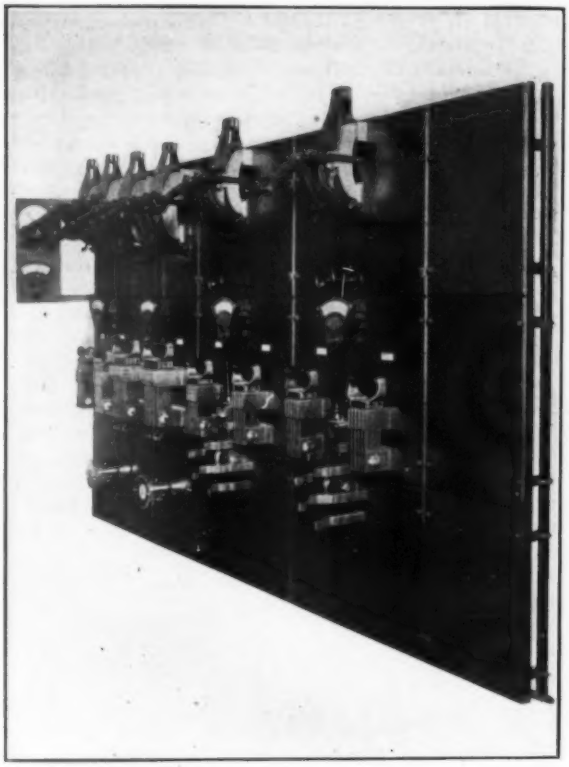


Fig. 6.—Direct-Current Switchboard With Heavy Switches and Circuit-Breakers.

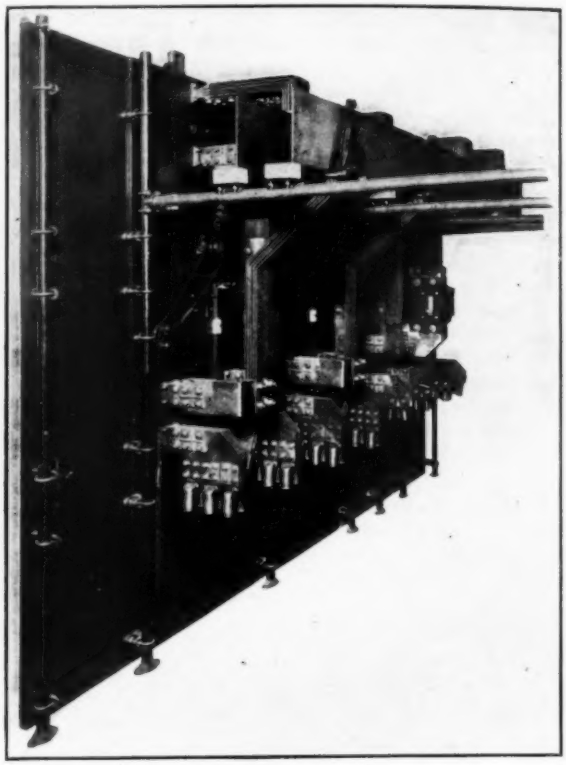


Fig. 7.—Rear View of Same Board. Note laminated studs.

for a circuit-breaker which is applicable to all conditions, as reactance or resistance in a circuit determines the amount of current that can be developed under short-circuit. The inherent reactance of generating or transforming apparatus also affects the amount of short-circuit current. Were it practical to find a uniform basis upon which to rate circuit-breakers, it would be better to define rupturing capacity as the maximum current which can be ruptured without rendering the circuit-breaker incapable of being again placed in service without repair. Several variables come in, however, to make such a method of rating difficult. Whatever definition is given, a rating can only apply to one exact condition, which must always be stated. At the present time the power companies, in taking the manufacturers' ratings, should, of course, be influenced by results of actual experience, and by a careful consideration of all conditions to be met.

Fig. 13 shows the disastrous results of failure to install heavier-duty oil switches as the generating capacity was increased. In this particular case the damage could probably have been confined to one oil switch if isolating compartments of masonry had been used instead of having everything mounted on the backs of the panels.

Fig. 14 shows a good design of small 2,300-volt switchboard which is suitable for stations of small generating capacity. Fig. 15 shows an example of a poor installation.

In laying out any alternating-current switchboard involving voltages above

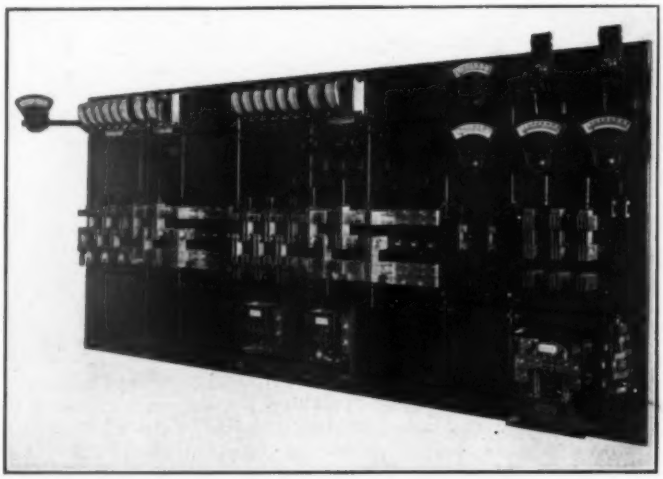


Fig. 8.—Direct-Current Three-Wire Board With Busbars on Front.

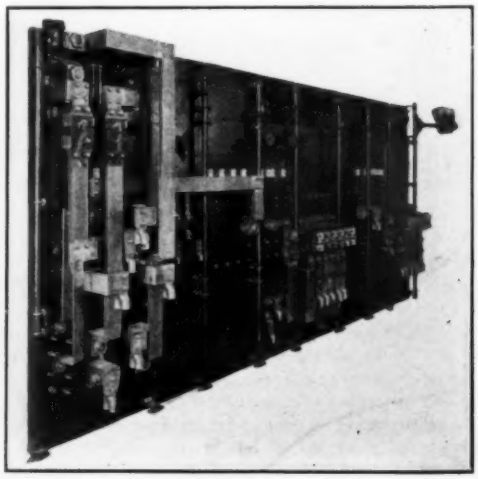


Fig. 9.—Rear View of Same Board.

3,300 volts or any voltage above 600 where the amount of power to be controlled is over 1,500 kilowatt, it is advisable to consider remote-controlled oil switches. Where the switches are not too large or where the space for the switches can conveniently be allowed within 10 or 15 feet of the switchboard, hand-operated mechanism with rods, levers and bell cranks may be properly used. In other cases solenoid, motor and air mechanisms may be better employed. In the case of electrically operated switches, it is recommended to always use knife switches for isolating the oil switches from bus or other live source to facilitate inspection and repair. Where continuity of service is essential, it is always advisable to use isolating switches even for hand-operated oil switches. Isolating barriers or compartments should always be used for remote-controlled

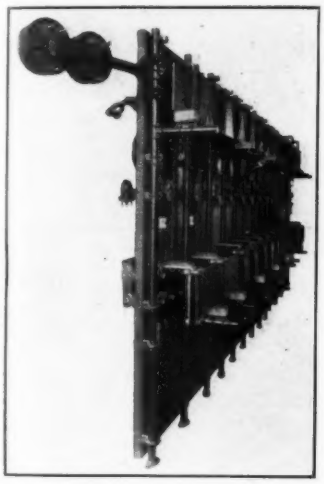


Fig. 10.—Buses Widely Separated.

oil switches for voltages from 6,000 to 15,000 where the total kilowatt capacity is above 2,500 kilowatt, and on the lower voltages about 7,500 kilowatts. These figures are not absolute, but represent what has been found to be good practice for average conditions. Conditions more or less severe than the average should be met according as they warrant.

Figs. 16 and 17 represent good types of control boards. Fig. 18 shows a neat installation making good use of pipe framework. Fig. 19 covers a good installation for 6,600 volts and moderate capacity. The oil switches, which are in compartments on gallery, are hand-operated from handles on panels on main floor. Buses are protected by slate slabs on which are mounted the potential transformers. Fig. 20 shows a large electrically operated installation (view before completion).

Busbars should be separated by barriers or placed in compartments when otherwise protect the bare live parts to prevent accident contact. Some-oil switches are installed with each pole isolated, but where oil switches are used with all poles in the same compartment, it is inconsistent to place the busbars in compartments. In such cases it is well to tape or

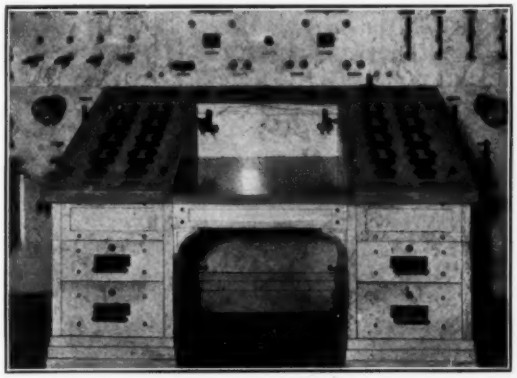


Fig. 11.—Control Bench.

Fig. 13.—Disastrous Results of Poor Design.

otherwise protect the bare live parts to prevent accidental contact. Sometimes a protecting metal cage is placed around the buses to prevent anything getting across them, the bars being far enough apart so that insulating is unnecessary.

For voltages above 15,000 volts compartments are used only in very high power stations where bottom or back-connected electrically operated oil switches or circuit-breakers are used. When using top-connected switches with heavy boiler-room oil tanks they can be spaced so that barriers or compartments are unnecessary.

For circuits above 15,000 volts, all live parts are usually left bare, being placed out of reach of accidental contact and with sufficient distance between the parts of opposite polarity to preclude chances of short-circuit.

The subject of safety to operators is one which is now occupying a great deal of attention on account of the fact that several states have passed laws making employers' responsibility for accidents more far-reaching than

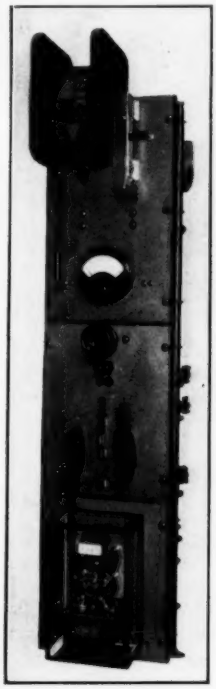


Fig. 12.—Direct-Current 1,200-Volt Panel.

heretofore. For self-protection against heavy liabilities, it is wise to spend a little money on safety. This applies more or less to switchboards, although the more responsible manufacturers of switchboards have for some time and to a certain extent included features of safety in their designs. The point is that all buyers of switchboards should have in mind safety to life when drawing specifications for switchboards and when deciding on the comparative merits of designs.

The following table of spacing has been found to be good practice.

On the circuit-breakers, fuses, etc.,

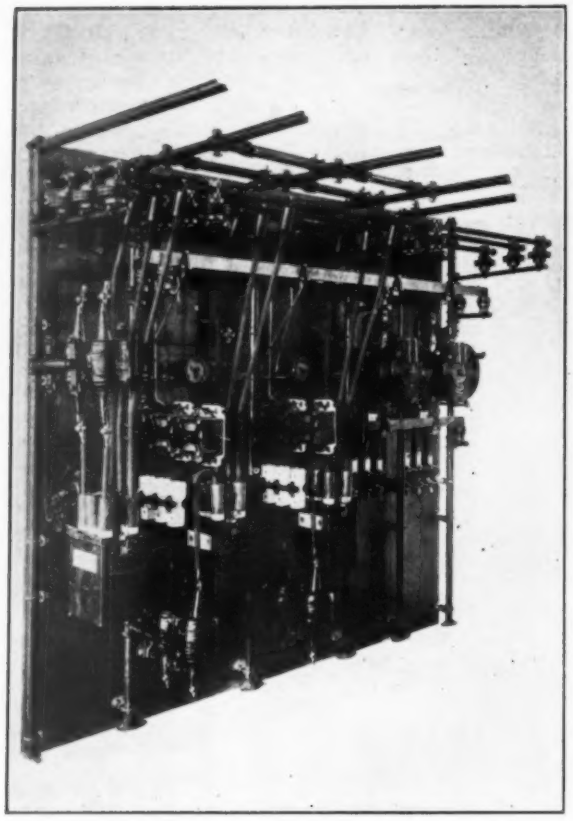


Fig. 14.—Good Design for Small 2,300-Volt Switchboard.

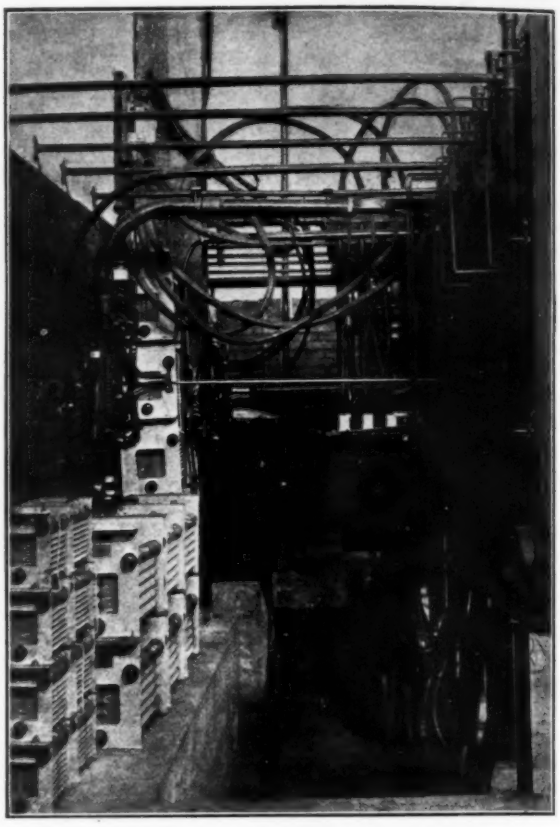


Fig. 15.—Poor Design for 2,300-Volt Switchboard.

where bars of the same polarity may obtain different polarity, when apparatus opens, figures given in the table should be used.

Supporting bolts for panels and other bolts connected to iron framework should be considered as grounded whether the framework is grounded or not.

Coming back to the actual switchboard panels, it may be said in general that the material best suited is natural black slate, which is not easily marred or stained, and can be readily matched when making extensions. An

ALLOWABLE DISTANCES BETWEEN LIVE PARTS OF OPPOSITE POLARITY AND TO GROUND

Voltage of Circuit	Distance Between Centers of Conductors of Opposite Polarity (Buses) in Inches	Minimum Distance Between Live Parts of Opposite Polarity in Inches				Minimum Distance Between Parts and Ground
		In Air		On Surface		
		Rigid	Not Rigid	Rigid	Not Rigid	Rigid
125		0.5	1	0.75	1.25	Same as between opposite polarities
250		0.75	1.75	1	1.5	
600		1	1.5	1.5	2	
1200		1.5	2	2	2.5	
2400		2	2.5	2.5	...	...
3300	6	2.5	4	3	...	2
7500	9	4	...	...	...	3
15000	9	5	...	...	...	3.5
22000	12	7.5	...	...	...	6
35000	18	12	...	...	...	10
45000	24	16	...	...	...	14
70000	36	24	...	...	...	24
90000	48	32	...	...	...	27
110000	60	38	...	...	...	33

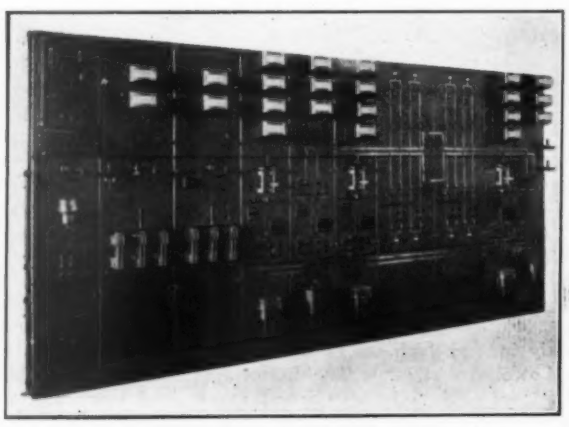


Fig. 16.—Vertical Control Board.

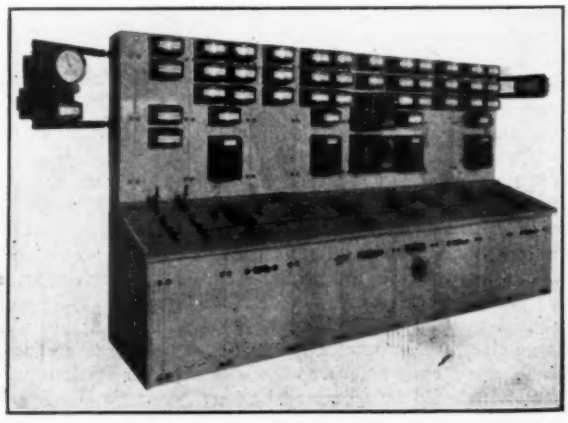


Fig. 17.—Bench Type of Control Board.

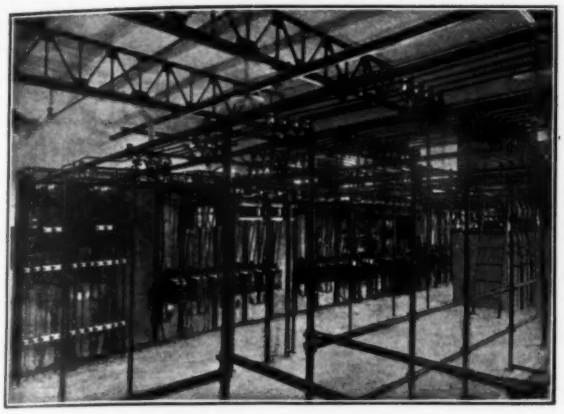


Fig. 18.—An Installation of Pipe Framework.

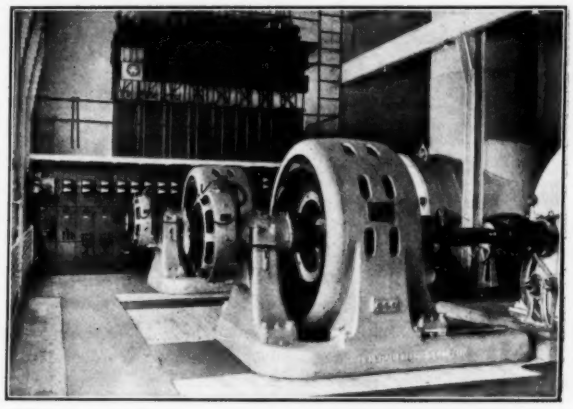


Fig. 19.—A Switchboard for 6,600 Volts.

exception to this would be where live parts connected to circuits whose voltage is above 1,200 volts are to be mounted directly on the panels, in which case marble should be used up to about 3,300 volts. Above 3,300 volts no live parts should be mounted directly on panels, and for the safety of the operator, it is best not to mount on front of the panel within easy reach, any parts directly connected to circuits of over 600 volts. When instruments are of the primary type in circuits of over 500 volts alternating-current the cases of the instruments should be connected to ground.

When the instruments are of the secondary type it is not difficult to provide suitable terminals and switches to make it easy to check the calibration of instruments and relays and to test out the various control circuits, and this provision should be insisted upon for all switchboards, except those for small plants. The small wiring on back of panel should be done neatly and regularly to facilitate tracing of connections and should be arranged in a manner best suited for connecting to the wires coming to the board.

A few words on illumination of switchboards might not be amiss. Some people still insist on lamp brackets placed directly on the switchboards, although there is nothing so unsuitable for good illumination, and these brackets are only justified on small isolated panels on account of cost. A horizontal reflector such as illustrated in Fig. 21 gives good results, but the most effective and satisfactory switchboard illumination can be had from indirect or semi-indirect lighting fixtures mounted away from the switchboard. If the general illumination of the station is correct, that is, gives sufficient light without shadows and glare on polished surfaces, no special illumination for the switchboard is required. One advantage of not having lighting fixtures mounted on the panel is the saving of the extra wiring that would otherwise be required. Good lighting makes it easier for the operator to make accurate instrument readings and saves strain on the eyes. It has been proven that eye strain is often the cause of nervous breakdown. A switchboard operator should be able to "keep his head" under all emergencies.

While on this subject it would be well to call attention to the need of some arrangement whereby provision is made for at least a few lights in case of general shutdown cutting off the main station lighting. This is usually accomplished by having a small storage battery (which may also be used for operating switches and circuit-breakers) to which a few lights are automatically connected the moment the main lighting circuit "goes off." A simple double or triple-pole, double-throw switch is provided with a strong spring which tends to throw the switch into the position which connects the lights to the storage battery. A low-voltage release mechanism latches the switch in the other position, holding it there as long as the main source of lighting is alive. If this source is shut off the low-voltage coil is de-energized, the latch releases, and the spring carries the switch to the position connecting to the storage battery. When service from the main source is restored, it is necessary to throw the switch back by hand or a more elaborate device can be made to be automatic in both directions.

Fig. 20.—Incomplete Installation of Electrically Operated Switches.

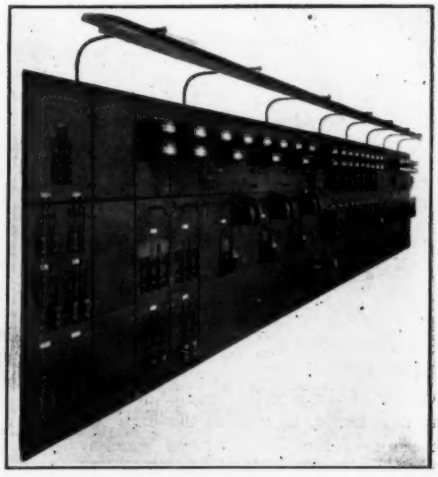


Fig. 21.—Switchboard With Horizontal Reflector for Lamps.

New Electrical and Mechanical Appliances

Reflectors for New Nitrogen-Filled Tungsten Lamps.

To meet the rapidly growing demand for lighting units to accommodate new high-efficiency nitrogen-filled 750 and

Fig. 1.

1,000-watt Mazda tungsten lamps, the Holophane Works of General Electric Company, Cleveland, O., has just completed the development of a line of reflecting and diffusing units for this service.

Fig. 2.

Because of the high intrinsic brilliancy of the new lamps, as well as the high temperature of the filaments and necessary change in lamp construction, it has become necessary to develop this entirely new line of lighting units to accommodate the new lamp.

Fig. 3.

These units, as shown in the accompanying illustrations, include enameled steel, prismatic and diffusing types. The designs here illustrated are typical of each class.

The semi-indirect unit shown in Fig. 1

Fig. 4.

consists of a Druid glass outer envelope within which is suspended a Holophane prismatic glass reflector; this latter directs the light upward toward the ceiling. Air passes downward between the reflector and envelope and upward through the center of the reflector, passing between the lamp and reflector.

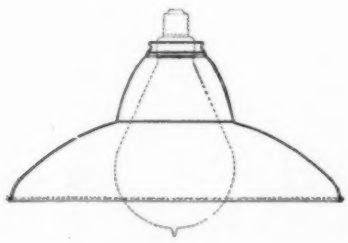
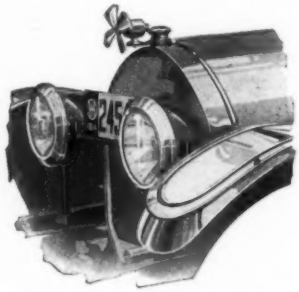


Fig. 5.

The diffusing unit shown in Fig. 2 consists of an outer envelope of heavy-density opal with a bowl at the bottom made of crystal roughed glass. Air enters around the lower band of the fixture and escapes through the hood above, as shown in Fig. 3.

For the illumination of platforms, shops, yards, etc., two types of enameled-steel reflectors have been designed, the deep-bowl and the shallow-bowl units. The screening angle of the shallow-bowl unit, shown in Fig. 4, is 85 degrees, while that

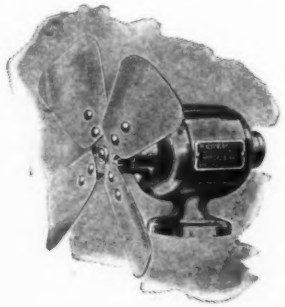


Novelty Fan on Automobile.

of the deep-bowl unit is approximately 70 degrees.

Robbins & Myers Automobile Novelty Fan.

As a feature of its advertising helps for electrical dealers and contractors, the Robbins & Myers Company, Springfield, O., has made up a small novelty fan which can be mounted on the radiator of



Enlarged View of Fan.

a motor car as shown by the illustration herewith.

The fan spins by the air current created by the motion of the car even when the car is running slowly. Being sym-

bolical of the electrical trade, it makes a dignified advertisement which appeals to every electrical dealer or contractor who has a motor car.

The base of the fan is taped for a stud bolt, and the usual method of mounting it on the car is to tap the cap which covers the opening to the radiator and mount the fan directly on this cap. Another method which can be followed is to mount the fan on an iron strap which is clamped around the cap, as shown in the illustration.

The fan can be furnished with either nickel or burnished-brass finish. This novelty fan was designed especially as an advertising help for dealers who handle Robbins & Myers "Standard" fans and is sold at a nominal price.

The Monarch Refillable Fuse.

The cost of renewal of cartridge fuses has proved very vexatious to all users that must employ them in either considerable quantity or in large capacities. This condition has developed a demand for a type of cartridge fuse that can be readily refilled at low cost and without disturbing the usefulness of the fiber containing shell or of the caps or other terminals. One of the manufacturers that has developed a fuse to suit this condition is the Monarch Refillable Fuse Company, 1048 Jefferson Street, Buffalo, N. Y.

Fig. 1.—Ferrule Type Fuse.

Monarch refillable fuses are made in several types, of which Fig. 1 shows the ordinary ferrule-contact type; the internal construction of this is shown in Fig. 2. The construction of this fuse is very simple. The fuse wire is passed through a hole in the inside washer and curled on the surface of this washer to give ample carrying capacity. It is then clamped between the washer and the cap by means of the end screws; this forms a good electrical contact. In the larger sizes, such as the one shown in Fig. 2, side screws are employed for preventing twisting of the cap. The washer has a projection which fits into a notch of the fiber tube and keeps it from turning when the screw is inserted.

Fig. 2.—Internal Arrangement of Fuse.

In Fig. 3 is shown the knife blade type of Monarch fuse, the illustration showing one end of the tube in section. The fuse element is in the form of a ribbon clamped between a pair of copper clips of spring copper and V-shaped; the clips have their inner ends shaped to hold the fuse ribbon and the outer ends bent to enter the grooved end caps. The knife-blade contacts are kept in perfect alinement by means of the grooved caps. To refill a fuse of this kind it is necessary merely to remove the side screws and then the end caps; the contact clips are thus made free and the powder filler can be shaken out of the tube. A new fuse ribbon is then inserted in one pair of clips and the fiber tube placed over and firmly pushed into the cap. The tube is then filled with the powder filler and the other contact clips, grooved cap and side screws are then secured in place.

The Monarch Company also makes fuses with screw-clamp contacts and a special type of refillable fuse has been developed to meet the severe requirements of steel plants.

Fig. 3.—Knife-Blade Type Fuse.

Ostrander Pull-Chain Socket.

There has been considerable demand for a pull-chain socket in which the chain itself is completely isolated from the live parts of the device by being so connected as not to touch any current-carrying part of the socket. There has also been need for a socket of this type that can carry something over its rated current without heating.

Pull Socket.

To meet these needs, W. R. Ostrander & Company, 22 Dey Street, New York City, have placed on the market a new pull-chain socket, an illustration of which is shown herewith. This socket has been developed as the result of much study in the design of devices of this type and possesses a number of interesting features that are said to be unique and exclusive. One of these is that the chain touches no current-carrying part of the socket; whereas in all other chain sockets the chain must be individually insulated. This feature eliminates all liability to shock and accident. Another feature is in having a double make and break mechanism, which is so designed and proportioned as to insure liberal current-carrying capacity for even a maximum overload without appreciable heating of the contacts. Another feature possessed by this socket is in the ingenious means for joining the cap and shell. This connection forms so firm and permanent a contact that the socket shell can easily bear the weight of the heaviest shade or reflector.

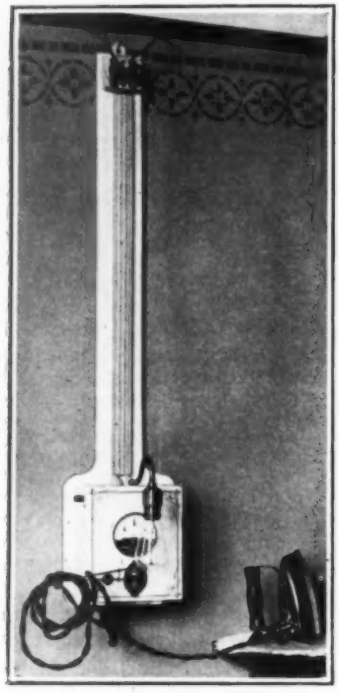
The Clement Electric Wall Cabinet.

In many of the older cities in this country it has been very difficult to secure the wiring of old houses and, therefore, in these places central-station companies have not had great success in extending their service to residences or apartments on a large scale. These conditions exist particularly in the older cities in the East and South. They have given rise to a demand for a low-cost and convenient means of securing some sort of electric service connection to such premises. This matter has been given great thought by W. E. Clement, commercial agent of the New Orleans Railway & Light Company, who has developed two devices to meet these needs. One of these is the Clement electric service table, which was described in our issue of August 31, 1912. Recently Mr. Clement has brought out an electric wall cabinet, an illustration of which is shown herewith.

This cabinet is designed for mounting on the wall and is a complete unit. It is hung upon the wall in any apartment or residence which is most accessible to the overhead distribution circuits of the central-station companies. The service wires are brought through insulating tubes through the wall and connected directly to a fuse block at the top of the cabinet. This block is connected by wood molding to the cabinet proper. The latter contains an electric meter, two push-button switches on opposite sides and two receptacles at the bottom. There is also provided a bracket for a tungsten lamp and a swinging bracket for supporting a cord which is to be used for a flatiron. The receptacle on the left is the flatiron outlet and directly above it is a small pilot lamp to serve as an indication of whether the flatiron circuit is closed or not. The receptacle to the right of the iron outlet is for use in connecting any portable device.

The entire outfit is all wired up complete and requires merely the mounting of the cabinet with its molding and wood mat upon the wall and the connection of the service wires to the fuse block as described above. Thus the installation can be made at a minimum cost both of labor and of material. The meter in the cabinet is tested and connected at the motor department of the central-station company before the cabinet is sent out.

These cabinets have been furnished at an extraordinarily low cost including the flatiron, which forms one of the most attractive inducements for the use of electric current, especially during the summer. It has been found that with this outfit as an entering wedge the conservatism of the customer gradually gives way and he becomes desirous of using other electrical conveniences, such as a fan, portable lamp, toaster, etc. As the enthusiasm for things electrical increases, it has been found that in many cases the entire house has been ordered to be wired. In many cases they have been installed for tenants where the owner of the house would not meet the expense of complete wiring. This wall cabinet is being manufactured by the Electrical Development Company, 928 LaFayette Street, New Orleans, La.

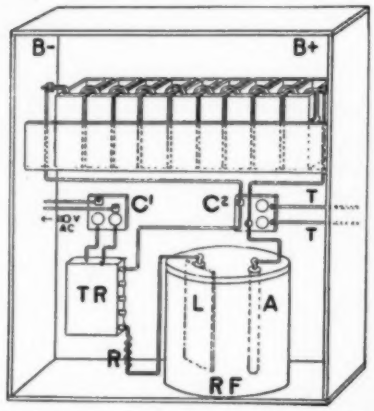


Clement Electric Wall Cabinet.

Storage Rectifying Unit.

For some time there has been a demand for an economical and convenient means for operating electric clocks, time stamps, private telephone systems, etc., from standard alternating-current supply circuits, such as are commonly in use by central-station companies. Since most of these uses require direct current at low voltage, there has been evident need for a means of obtaining such current from the alternating current supplied at low initial and maintenance cost.

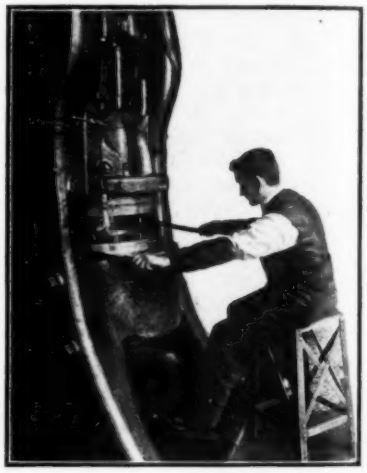
The Electric Economy Company, Hyde Park, Mass., has anticipated these needs by the development of a compact and combined rectifying and storage unit. As shown in the accompanying illustration, this consists of a step-down transformer, which is connected to the alternating-current supply circuit through the cutout block *C'*. A number of secondary taps are arranged on this transformer so that the secondary voltage may be adjusted through a range of values. Connected into one side of the secondary circuit is a regulating resistance *R* and the electrolytic rectifying cell *R F*. This latter consists of a special electrolyte in which are immersed a graphite or lead anode *L* and an aluminum cathode *A*. This arrangement permits a flow of current from the anode to the cathode but not in the reverse direction. The terminals of the secondary circuit pass through a cutout block *C²*, across which is connected a storage battery of as many cells as are needed for the particular requirements to be met. Connected to the same coutout block are the wires *T T* to which the clock or telephone circuit is connected. The arrangement is such that the storage battery is connected across the secondary circuit at all times and receives a slow continuous charge. This is so proportioned by adjustment of the voltage of the secondary circuit and by the number of cells connected into the storage battery that it keeps the battery in good working condition at all times and supplies slightly more energy to the battery than is actually needed for the operation of the low-voltage direct-current circuits in the building.



Arrangement of Storage Rectifying Outfit.

The manufacturer of this equipment states that it requires the minimum of attention. Pure water must be added to the rectifying cell and to the storage-battery cells several times a year to replace evaporation. Depending upon the load connected with the low voltage direct-current circuit, there must be renewal of the electrolyte and of the electrodes of the rectifier at intervals ranging from one to four or five years. The storage batteries commonly supplied have a capacity of six ampere-hours, which has been found amply sufficient to ring a small bell more than 100,000 times. Since the battery is maintained continually in excellent charged condition, its life is indefinite and, unless subjected to violent abuse, should be more than 10 years at least. The elements used in the battery are of the simple couple type and the liability for short-circuit or other troubles is practically eliminated.

In a typical installation of this type there were operated 24 clocks in multiple, each requiring 0.1 ampere for about one-third second each minute. The voltage was 24 volts, so that 12 cells constituted the battery.



Safety Device for Punch Press.

There was also connected a relay and a winding magnet for the master clock; these drew 0.1 ampere each minute for about one-third second; 24 small bells each drawing about one-fourth ampere and ringing about 20 times per day were also connected. The current supplied was 110 volts, 60 cycles. The equipment for this purpose has been in use for a considerable time without any appreciable evidence of deterioration.

Safety Suction Devices for Punch Presses.

For some time the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., tried mechanical safety devices of various kinds for the punch shop but with unsatisfactory re-

sults. The operators found them unsuited because of the fact that they tended to retard the production and consequently their earnings while the management also objected to them because they afforded only partial protection, as the operator had to place his hand under the press in every instance in order to remove the scrap.

The suction device illustrated herewith was developed with the idea of preventing the necessity of the operator approaching the danger point at any time during the operation, as he feeds and clears the press with the same tool. Another advantageous feature is that the operator does not take hold of the material with his hands (this applies principally to the smaller sizes) and thereby escapes the numerous small cuts to which he was subjected when inserting the blanks with his fingers.

The double handle device used on large work and shown herewith is absolutely safe, the operator being compelled to use the device owing to the size of the sheets handled, it being impossible to get hold of the sheets in any other way.

Before adopting this method a man was placed at the back of the press to feed in the sheets and he was the man who most frequently was injured because his fingers were entirely at the mercy of the operator.

Since the adoption of the suction device there has not been an amputation on the large presses and up to the present time no finger has been amputated in the punch shop. This freedom has been due to the operation of the devices and the rigid enforcement of the rules by the management of the shop.

The suction device was exhibited and received the grand prize at the recent International Exposition of Safety and Sanitation and is now on exhibition in the America Museum of Safety in New York City.

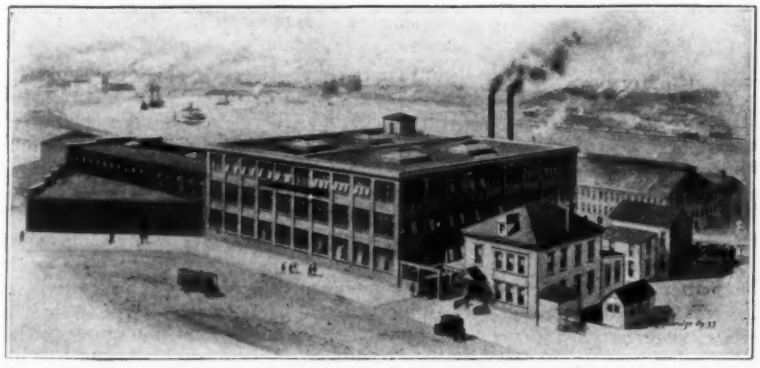
Enlarged Field for Storage-Battery Manufacturer.

An interesting event in the storage-battery industry is the change in the name and the location of the company which has heretofore done business as the Baltimore Electric Storage Battery Company with factory and offices in Baltimore, Md.

Henceforth the company will be known as the Titan Storage Battery Company. Extensive new quarters have been secured in Newark, N. J., at Chapel Street and Lister Avenue, at which point the offices of the company have been established for some time and the manufacturing equipment is now in operation so that Titan vehicle batteries, Plante batteries, lighting and sparking batteries and self-starter batteries are being shipped from the new location.

The removal was brought about by the necessity for increased facilities and the fact that the Newark location possesses advantages over what could be procured in Baltimore. The change in the name is a move in the direction of simplification and is made possible through the fact that it is no longer desirable to identify the company name with the location.

The officers of the Titan Storage Battery Company are: Henry M. Keith, president; Daniel C. Spruance, vice-president; Edward S. Hyde, treasurer; Henry M. Hanson, secretary. These gentlemen with Minor C. Keith and John G. Gray constitute the board of directors. Dr. W. E. Winship is general manager, A. H. Mustard is sales manager, and Eugene Handler is superintendent. No change in the policy of the former company, beyond that of enlargement and expansion of operations, is indicated by the change in name and location. The control continues in the hands of Minor C. Keith, vice-president of the United Fruit Company and president of the International Railways of Central America.



New Factory of Titan Storage Battery Company.

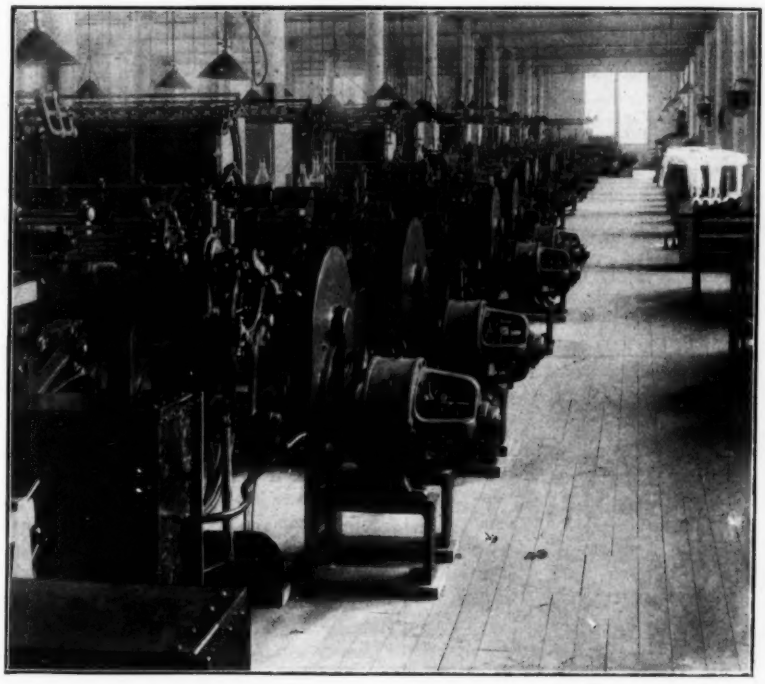


Fig. 1.—View in Hosiery Mill, Showing Motor Drive.

Adjustable-Speed Motor Drive for Hosiery Machines Results in Increased Production.

Above is shown the interior of one of the mills engaged in manufacturing "Onyx" hosiery and illustrates many of the advantages of motor drive, such as the absence of belts, good lighting, freedom in arrangement of machines, cleanliness, etc. This installation is especially interesting, however, on account of the automatic control used to adjust the speed of the motors, thereby securing a considerable increase of

production over a constant-speed drive.

In the knitting of full-fashioned hosiery a slower speed is required when fashioning (that is, shaping) than is necessary when knitting the straight part. If constant speed is used, the limit of output is determined by the maximum speed which can be satisfactorily used when fashioning. But with an adjustable-speed system where the speed of the machine can be increased while knitting the straight and reduced when fashioning, it is evident that production can be materially increased, especially since the time required for fashioning is only a small percentage of the time required for the entire operation.

In the factory shown in the illustration, there are over 200 automatic stocking machines imported from Saxony. Each machine makes nine pair of hose at a time and is driven by a 1.5-horsepower Westinghouse adjustable-speed direct-current motor.

Fig. 2.—Near View of Control Panel.

The control consists of a Westinghouse textile oil switch, operated by the shipper rod, a speed controller and an automatic self-starter—the last two being mounted in a sheet-metal cabinet together with a main-line knife switch and a circuit-breaker, as shown in Fig. 2. When starting the machine, the operator moves the shipper rod and closes the oil switch, which causes the self-starter to operate and automatically starts the motor. In case of accident or trouble with the machinery overloading the motor, the circuit-breaker opens and stops the machine.

By adjusting the controller the operator sets the motor speed at the desired maximum value for knitting the straight. When fashioning takes place, the endwise movement of the main drive shaft of the machine is used to automatically reduce the motor speed. As soon as the fashioning strokes are completed, the machine resumes knitting at the higher speed until fashioning again takes place. This method of reducing the speed is also frequently used nonautomatically for plating, or reinforcing the soles and heels of silk hosiery with cotton.

Central Electric Company Publishes Valuable Map and Record of Mexico Situation.

The Central Electric Company, 320 South Fifth Avenue, Chicago, with its usual enterprise and aggressiveness, has prepared for distribution a 14-inch by 21-inch map of Mexico showing the position of the contesting armies in Mexico as well as the location of the United States forts along the border and the position of the United States battleships will have assumed during the week. The map is claimed to be absolutely authoritative, is printed in colors and will give at a glance an idea of the size of Mexico and the amount of territory covered by the army and navy of both Mexico and the United States. It will be sent free to readers of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN making request for it on business letterheads.

Standardization of Electrical Supplies in China.

The Engineering Association of China, having headquarters at Shanghai, has undertaken the standardization of electrical supplies throughout China. This is proving a rather difficult undertaking because of the great variety of supplies now shipped into China from various parts of the world. It is recognized, however, that far-reaching benefits would result from the proposed standardization, and as a result the consuming public is encouraging the movement. The officers and directors of the Engineering Association of China are as follows: J. S. S. Cooper, chairman; R. A. Williams, secretary; T. H. U. Aldredge, H. H. Arnold, N. G. Beale, J. E. Burgess, L. Jungninger, E. Kocher, L. Laforest, and S. S. Sellick.

In case it is possible to bring about the desired standardization it is believed that the following advantages would be secured: (1) buyers of electrical plant will receive tenders on a comparable basis; (2) the possibility in interconnecting different systems and the consequent use of large bulk supplies which is almost impossible in many of the larger European cities; (3) minimizing the variety of electrical stock, such as lamps, meters, motors, transformers, and general supplies, kept at the trading centers; (4) the interchangeability of appliances.

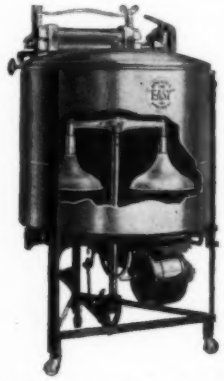
New Electric Washing Machine.

The illustration herewith shows a new type of washing machine manufactured by Dodge & Zuill, Syracuse, N. Y. The distinguishing feature of this machine is that it washes by air pressure and suction instead of by friction. It is said by the makers that this principle not only cleanses thoroughly but is also especially desirable because it is harmless to the fabric.

The washer is provided with two suction basins which work up and down forcing the water through the clothes and sucking it back again, turning automatically at the top of each revolution for a new position on the downward movement. This produces a strong agitation of the water through the clothing without subjecting the clothing to rubbing.

The tub is made of cold-rolled copper, securely double-seamed to the bottom and soldered. The tub is 24 inches in diameter and 18.5 inches deep.

The machine is driven by a one-eighth-horsepower "Standard" motor made by the Robbins & Myers Company, Springfield, O. The motor is attached to the supporting plate by two thumb-screws, making it easily detachable for operating other machinery if this is desired.



Electric Pressure and Suction Washer.

By pulling a lever the motor drive is shifted from the washer to the wringer and the speed of the motor is reduced from 60 impulses per minute on the washer to 42 revolutions for the wringer. Instant reverse of the wringer is secured by means of a small lever conveniently located near the end of the upper roll.

Aluminum Company Buys Power.

The Tennessee Power Company has begun delivery of current from its development No. 2, on the Ocoee River, to the initial plant of the Aluminum Company of America at Maryville, Tenn., under a contract calling for the supply of about 20,000 horsepower.

Current Electrical News

NORTH ATLANTIC STATES.

BANGOR, ME.—As soon as weather conditions will permit, the Bar Harbor & Union River Power Company will begin the building of a transmission line from its great power station at Ellsworth, 18 miles along the county road, to Bluehill and the Brooklin town line.

BRANDON, VT.—The Hortonia Power Company has been incorporated for the purpose of developing hydroelectric power in the neighborhood of Hortonville. The capital stock is $50,000 and the incorporators are Edward D. Blackwell, Frank E. Chandler, Tom W. Ray, of Brandon; A. G. Stone, of Sudbury; A. W. Hyde, of Rutland, and W. H. Horton, W. A. Jennings and David L. Wells, of Orwell. An extensive water power plant is to be built and equipped by the company at Hortonville in Rutland County to harness the water power of Lake Hortonia and Huff, Buff and Hinkun ponds for the purpose of manufacturing electric current. The office of the company will be at Brandon.

NEW YORK, N. Y.—A syndicate of New York capitalists is said to have a scheme to construct a $2,000,000 power plant on the west bank of the river near the north end of Maplewood Park. It hopes to induce the state to allow it to draw water from the Barge Canal at the western widewaters and to grant it the right to take property by condemnation proceedings when necessary for the construction of a canal or conduit from the widewaters to the river bank. Richard B. Hayden, who is actively interested, believes that they will be able to develop about 20,000 horsepower.

HOBOKEN, N. J.—An individual power plant comprising boiler and engine room will be installed in the new furniture factory to be erected by the Ferguson Brothers Manufacturing Company, it is reported.

MORRISTOWN, N, J.—The Morris County Traction Company has contracted with the Morris & Somerset Electric Company for electric power for the operation of its line from Chatham to Danville, the service to be supplied from the company's Morristown plant. The Traction company will install new rotary transformers at its various stations. A.

TRENTON, N. J.—The Public Service Company has completed the installation of a new street-lighting system at Trenton Junction. The company is also planning to supply local resident service throughout this section. A.

SOUTH ATLANTIC STATES.

DOVER, DEL.—Electrical Power Company of Western States of America has been incorporated with a capital stock of $3,000,000 to furnish electrical power of all kinds for generating plants; also to hold, own and use bonds, debentures and other securities. The incorporators are Herbert E. Latter, W. J. Maloney and Oscar J. Reichard, of Wilmington, Del.

LOGAN, W. VA.—The Logan & Eastern Telephone Company has been organized here with a capital stock of $25,000 by B. E. Chatfield, L. Epperly and others.

VALDOSTA, GA.—The South Georgia Power Company has been organized with a capitalization of $2,500,000 to erect a hydroelectric plant on the Withlacoochee River near here. The company plans a distributing system covering the territory about Valdosta.

NORTH CENTRAL STATES.

COLUMBUS, O.—J. W. & W. J. Dusenbury, the new lessees of the Grand Opera House, will expend $100,000 on the same, including new electrical equipment. J.

HOWENSTINE, O.—The O. C. Barner Mining & Fertilizer Company announces plans to construct an electrical power plant that will cost over $1,000,000. The company will seek contracts to supply numerous towns in the vicinity with electricity. J.

MANSFIELD, O.—The new system of electric lighting recommended for this city by H. Whitford Jones, consulting engineer of Cleveland, calls for an outlay of $250,000, including a new power plant. Nitrogen tungsten lights are specified. J.

SULLIVAN, O.—The Council is planning ways and means to secure electric lighting. Address the village clerk.

EAST GARY, IND.—The Council plans to establish a $9,000 municipal lighting plant. Address the city clerk.

MARENGO, IND.—The taxpayers have just voted favorably on a proposition for the installation of an electric light plant in this town. Details of the improvement have not been agreed upon as yet. G.

MOONEY, IND.—Jackson County Mutual Telephone Company has been incorporated with a capital of $3,000, by K. E. Tanner, Harry Doods, K. W. Lockmann.

SPRINGFIELD, ILL.—The Pekin Streets Railway Company has been incorporated with $15,000 capital stock. The incorporators are W. E. Lautz, D. D. Velde and W. P. Herget.

UNIONVILLE, MICH.—An $8,000 municipal light plant will be established. Address the village clerk for further information.

WHITE PIEGON, MICH.—The Council is planning ways and means to establish electric lighting. Address the village clerk.

NEW RICHARD, WIS.—The River Falls Power Company has voted to build another electric power transmission plant and a 90-foot reinforced-concrete dam across the Kinnickinnic at a point about a mile and a half above the present power plant at Clifton.

COMFREY, MINN.—W. C. Buck, of Minneapolis, has been engaged to prepare plans and specifications for an electric light plant.

DEER RIVER, MINN.—The Farmers Telephone Company has been organized and will build a line north of Ball Club Lake. T. Ruff is president.

EMBARRASS, MINN.—The Embarrass Farmers Co-operative Telephone Company has been incorporated by Oscar Salminen, John Koski, and others.

MADELIA, MINN.—A company has been organized here by business men to establish a "White Way" lighting system. C. S. Christiansen is chairman.

EARLVILLE, IOWA.—The Mayor and Council are forming plans for a new lighting plant. Address Mayor Van Fleet for information.

FORT DOGDE, IOWA.—Homer Lorring, president of the Ft. Dodge electric line, which also owns the Crooked Creek Railroad extending from Webster City to Lehigh, has told the Webster City and Lehigh people that he will rebuild the line and electrify it and carry it west about four or five miles if the people in the towns and territory traversed will give him a bonus of $30,000.

IOWA FALLS, IOWA.—It has been decided to grant a franchise for a new heat, light and power company. The present plant is owned by Oscar F. Peterson of Des Moines.

NEVADA, IOWA.—The Iowa Railway & Light Company, Cedar Rapids, will install a line between here and Maxwell. J. C. Young, Cedar Rapids, is the representative of the company.

KANSAS CITY, MO.—At a recent meeting of the City Council of Kansas City, 12 ordinances providing for the installation of tungsten lamps on certain streets were passed. The electric illumination replaces gas in most cases. M.

KANSAS CITY, MO.—The Board of Park Commissioners is contemplating two propositions calling for overhead wire work in Swope Park. An offer has been made to install a trackless trolley system in the park. The Board will choose between this method and the granting of a franchise to the Metropolitan Street Railway Company, which would allow the latter to extend its lines into the park. Cusil Lechtman is chairman of the board. Mayor Henry L. Jost and others are also interested. M.

AVON, S. D.—The Town Council has granted to John Burbeck a franchise to install a plant to supply electric light, heat and power.

BEATRICE, NEB.—W. C. Ross, receiver of the Nebraska Public Service Company, will rebuild the power house and lines here.

WAKEFIELD, NEB.—A 15-year franchise has been granted to Gust Wendt, of Winside, who will install an electric light plant for the town.

ATCHISON, KANS.—A power plant is to be built at Atchison by the McKinley interests at a cost of $200,000. The plant will provide light and power

for a number of small towns between Atchison and Topeka, and Achison and St. Joseph, Mo. A. M. Patten, of Topeka, Kans., is assistant general manager of the company. M.

EFFINGHAM, KANS.—The Council plans to install a $12,000 municipal lighting plant.

FORT SCOTT, KANS.—The Fort Scott & Pittsburg Railway Company, which proposes to construct an electric road 35 miles in length between those two cities, has been granted permission to issue bonds in the sum of $950,000 by the Kansas Public Utilities Commission. A. B. Dickman, of Fort Scott, is president of the Road. M.

GARDEN CITY, KANS.—The Garden City Irrigation Power Company has been given permission to do business in Kansas as a public utility and will build transmission lines for 40 or 50 miles up and down the Arkansas Valley from the power plant of the Garden City Sugar & Land Company, which company it controls. M.

HORTON, KANS.—Scott Brothers, of Concordia, have secured a contract for the erection of a new city hall, which includes a lighting plant. M.

OTTAWA, KANS.—The Home Telephone Company is contemplating the expenditure of $75,000 on a new plant at Ottawa, provided proper inducements are extended. C. F. Adams, of Kansas City, is vice-president of the company. M.

PLATTSMOUTH, NEB.—The Omaha-Lincoln Railway & Light Company, of which William McKinley is president, will extend the electric road to Plattsmouth. H. B. Chubbuck and William Mattis, of Omaha, are vice-presidents of the company. M.

WELLSVILLE, KANS.—C. A. Smith, a retired capitalist of Wellsville, will install an electric light plant in this city at a cost of $25,000. M.

SOUTH CENTRAL STATES.

MACKVILLE, KY.—The Thompson Telephone Company has been incorporated by J. W. Russell, J. E. Carpenter and others.

MAYSVILLE, KY.—The city is planning to construct an electric light system here to cost $22,000. Address the mayor.

ELKMONT, TENN.—The Appalachian Club will enlarge the electric-light and waterworks system. Address the secretary of the club at Knoxville.

JAMESTOWN, TENN.—The Home Telephone Company has been incorported with a capital stock of $1,000, by D. A. Todd, J. F. Cross and others.

PARIS, TENN.—The city is considering plans for rebuilding the electric light plant, changing the system from three-wire direct-current to 60 cycles, alternating current.

GREENVILLE, MISS.—The Delta Light & Traction Company has been incorporated with a capital stock of $200,000, by E. J. Lenz, F. N. Robert Shaw and others.

ASHDOWN, ARK.—The Southwestern Telegraph & Telephone Company plans to erect a new plant here soon. It is reported that $10,000 will be spent.

HARRISON, ARK.—The Harrison electric plant will be rebuilt. Address George D. Locke, Rogers, Ark., who is president.

HORATIO, ARK.—The DeQueen Ice & Light Company has secured a municipal franchise to furnish electric lighting.

CEMENT, OKLA.—The High View Telephone Company has been incorporated by C. H. Mabrary, E. E. Swinney, of Cement, and others.

MEHAN, OKLA.—Stillwater Valley Telephone Company has been incorporated with a capital of $2,000 by C. A. McKenzie, Wm. Varley and V. Confry.

ALPINE, TEX.—The Alpine Light & Ice Company has been organized here with a capital stock of $20,000. J. D. Jackson is interested. D.

DALLAS, TEX.—The Northern Texas Utilities Company has been organized with a capital stock of $500,000 with headquarters at Dallas. The purposes are the manufacture and sale of gas, electric current and power; the manufacture and sale of ice, and the supplying of water for power, municipal and other purposes. The incorporators are Hiram Grosman, W. C. Woodlief and W. T. Heninger, all of Dallas. D.

FRANKLIN, TEX.—Bonds have been voted for a light and water system. Address the mayor for information.

GRAHAM, TEX.—The Graham Independent Telephone Company has been organized here with a capital stock of $15,000 and will build an exchange and system. W. H. Mayes, J. P. Hamilton and Robert Bower are the incorporators. D.

HICO, TEX.—The Hico Electric Light & Power Company is planning to construct 22 miles of transmission lines, also to install additional turbine and boiler and tub transformer for incandescent lamps.

SHERMAN, TEX.—The Texas Light & Power Company will expend $18,000 in improving its plant and system here. D.

WESTERN STATES.

ANTELOPE, MONT.—A local telephone exchange will be built here, and rural lines constructed. Address F. D. Morck, secretary, for desired information.

BLOOMFIELD, MONT.—Work will soon commence on lines of the Farmers Telephone Company recently organized here, with L. I. Brown, secretary.

REED POINT, MONT.—The Reed Point Telephone Company will install a central station and connect with White Beaver Line.

NEZ PERCE, IDAHO.—The Grangeville Electric Light & Power Company, operating in this city, recently announced its intentions of making needed extensions and improvements to the local system. The improvements include new transformers, repoling electric line in town, reconstruction of the line to the LO-LO Power site and the installation of some new generating machinery. Address the company here for further information. O.

LEWISTON, IDAHO.—A committee including F. W. Emery and A. M. Roberts, of this city, has been appointed by the Mayor and City Council to investigate the securing of a suitable site on the Clearwater River for a municipal power plant. In all likelihood, the matter of building this utility will be placed before the voters of Lewiston at a special election. O.

NOGALES, ARIZ.—The Mountain States Telephone Company has been ordered by the Corporation Commission to reconstruct and rebuild its telephone system here. D.

PRESCOTT, ARIZ.—The Pacific Water Company has started surveys for the establishment of two power plants on Verde River, below Fossil Creek, and another 12 miles below Camp Verde. The new plants will supply Globe and Miami districts.

MT. VERNON, WASH.—The County Commissioners of Skagit County at a recent meeting granted the Stone & Webster Interests a franchise for the extension of light and power lines along certain roads in the county. It is understood active construction will be started during the month of May. O.

REPUBLIC, WASH.—Z. E. Merril and A. L. Capers recently purchased the property of The Republic Light & Power Company and announced their intentions of making a considerable number of changes and new installations among which will be a new turbine, generating system, flume, etc. Address the company, here. O.

SEATTLE, WASH.—Wilkeson Power, Light & Fuel Company has been incorporated with a capital of $500,000 by F. L. Van Nice, J. L. Teig and Thomas M. Tennent.

SPOKANE, WASH.—The Spokane & Inland Railway Company will install a rotary convertor to cost $15,000 in a new substation to be built at McGuire's, on the Coeur d'alene Division of the road, the work to be in charge of the Electrical Department. O.

SPOKANE, WASH.—The Spokane Valley Power Company will increase its capital stock from $200,000 to $2,000,000 to furnish funds for the development of an electric power site below Fort Wright, near this city. The plant to be constructed will have a 20,000-horsepower capacity. For further information address W. W. Corey, Finch Investment Company, Spokane. O.

BAKER, ORE.—The South Baker Power plant of the Eastern Oregon Light & Power Company, here, was recently destroyed by fire. The loss is estimated at $75,000. According to all reports the demolished plant will be rebuilt in the immediate future. O.

GOLD HILL, ORE.—A well authenticated rumor is prevalent in this city to the effect that the Rogue River Public Service Corporation, George E. Sanders, president, plans the construction of a $500,000 power plant, capable of developing 5,000 horsepower, near this city. It is also rumored that a plant similar to the one to be built here will be constructed between Gold Hill and Grants Pass during the coming summer. O.

THE DALLES, ORE.—Fire recently destroyed the U. S. Government machine shop and electric light plant on the Dalles-Celilo Canal Project, at Big Eddy. The loss is estimated at $40,000. O.

WALLOWA, ORE.—This city is contemplating the construction of a municipal light plant at a probable cost of $34,000, which includes diversion dam, pipe, distributing system, etc. Address the city clerk. O.

DRAIN, ORE.—An ordinance has been passed authorizing the construction of an electric light plant, and for issuance of $15,000 in bonds to pay for the same.

FRESNO, CAL.—The Board of Supervisors has given notice that on May 5 a

50-year franchise will be sold to the highest bidder for an electric railroad along the county road on Fresno Avenue, applied for by the Fresno Interurban Railroad Company.

FRESNO, CAL.—Negotiations are under way between property owners southeast of Fresno and the Fresno Traction Company for the construction of an interurban line to Calwa, a distance of about three miles.

SAN BERNARDINO, CAL.—The Rialto Light, Power & Water Company has been granted a franchise in this city.

PROPOSALS.

ELECTRIC CABLE.—Sealed proposals will be received at the office of the General Purchasing Officer, Panama Canal, Washington, D. C., until May 8 for furnishing motors, electric cable, etc., under Panama Circular 845.

ELECTRICAL APPARATUS.—Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until May 11 for furnishing electrical apparatus for the Okanogan Project, Wash. Further information can be obtained from the above-named department in Los Angeles or Washington.

INTERIOR LIGHTING FIXTURES, ETC.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., for furnishing interior lighting fixtures until May 14 for the postoffice at New Orleans, La.; until May 16 of a two-story building for the postoffice at New Rochelle, N. Y.; until May 18 of a one-story building for the postoffice at La Fayette, La.; until May 27 of a one-story building for the postoffice at Pulaski, Tenn.; until May 28 of a one-story building for the postoffice at Canton, O.; until May 29 of a one-story building for the postoffice at Casper, Wyo., and a two-story building for the postoffice at Rocky Mount, N. C. Drawings and specifications may be obtained from the office of the Supervising Architect or the custodians of the sites named.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following electrical equipment for the Navy Yards names in each case: Until May 5 for three one-ton and three half-ton self-contained electric hoists, as per Schedule 6663, Norfolk, Va.; 8,000 feet solid weatherproof triplex-covered copper wire, 52,600 centimeters, Norfolk, Va., and 1,500 feet single and duplex rubber-insulated wire, 2,300 centimeters, lead-covered, Brooklyn, N. Y., both as per Schedule 6664; 6,200 feet insulated and lead-covered cable, 500,000 centimeters and 212,000 centimeters, and 3,000 feet lead-covered insulated-paper telephone cable, 50-pair and 25-pair, as per Schedule 6665, Newport, R. I.; 1,400 feet 2,400-volt four-conductor submarine cable, as per Schedule 6655, Fort Lafayette, New York Harbor; 5,000 feet soft-steel leaded and armored single-conductor wire, 9,000 centimeters, as per Schedule 6657, Brooklyn, N. Y.; telephone switchboard, front-connection type for ship's service, and telephones and spare parts, as per Schedule 6658, Philadelphia, Pa.; until May 12 for furnishing 58,300 pounds seamless-drawn condenser tubes, Composition "A," five-eighth inch O. D., 13 feet 2.25 inches long, as per Schedule 6674, Norfolk, Va.; 100 wavemeters, as per schedule 6675, Brooklyn, N. Y.; until June 2 for furnishing 5,000 electric primers, three-foot wires, as per Schedule 6660, Pearl Harbor, Hawaii.

NEW INCORPORATIONS.

MARION, ILL.—Ohio Valley Electric Company has been incorporated with a capital stock of $2,500 by F. H. Wykes, E. Lewis and E. T. Gallagher.

MEXICO, IND.—Mexico Electric Company has been incorporated with a capital stock of $2,500 by Melvin E. Smith, George B. Wilson and Mabel Smith.

INDEPENDENCE, MO.—Independence Electric Supply Company has been incorporated with a capital stock of $20,000 by Henry S. Esler, Lloyd E. Allen and Virginia Esler.

DOVER, DEL.—The Maryland Electric Vehicle & Manufacturing Company has been incorporated with a capital of $100,000. The incorporators are residents of Dover, Delaware.

SHEPHERDSVILLE, KY.—The Shepherdsville Electric Light, Water & Cold Storage Company is being organized here, with a capital stock of $10,000. S. W. Bates is president.

SAN LUIS OBISPO, CAL.—The Santa Maria Gas & Power Company has been incorporated with a capital stock of $1,000,000 by T. B. Adam, P. O. Tietzen, J. F. Goodwin, J. E. Walker et al.

INLAND, N. Y.—Inland Telephone Company, Incorporated, has been granted articles of incorporation, capitalized at $5,000, the incorporators being Adam Kaiser, John Kaiser and H. W. Long, all of Grand Island, N. Y.

NIAGARA FALLS, N. Y.—Niagara Searchlight Company, Incorporated, has been granted articles of incorporation, with a capital stock of $100,000. The incorporators are James F. Murphy, John Tugby and Firnum G. Anderson, all of this place.

NEW YORK, N. Y.—Alpha Electric Company, Incorporated, has been granted articles of incorporation, capitalized at $25,000, to deal in electrical apparatus, etc. The incorporators are George H. Makepeace, J. Milton Ferry and P. Joseph Carbone, all of this city.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Midland Counties Public Service Corporation, with a capital stock of $2,000,000, by William Kerckhoff, A. C. Balch, Kasper Cohn, A. Haas, A. G. Wishon and A. E. Wishon.

CHARLOTTE, N. C.—The Piedmont Electro-Chemical Company has been incorporated with a capitalization of $100,000 by I. Hechenbleikner, D. C. Carmichael and E. R. Bucher. The company proposes to manufacture, deal in, buy and sell alkalis and chemicals.

MANHATTAN, N. Y.—South Electric Manufacturing Company has been incorporated with a capital stock of $25,000 to manufacture and deal in machinery, devices, general contracting, electrical and mechanical engineering. The incorporators are William S. Lison, Charles R. Pedle and Lewis C. Randolph, all of New York City.

CLEVELAND, O.—F. M. Grant Electric Company has been incorporated with a capital stock of $10,000 to deal in all kinds of electrical supplies, and engage in wiring and construction work. The incorporators are F. M. Grant, M. L. Thomson, H. B. McGraw, Frederick A. Henry and Vernon E. Davis.

FINANCIAL NOTES.

The issue of $3,000,000 first-mortgage 5s of the Chicago Railways Company offered by local bankers have all been sold.

El Paso Gas & Electric Company has called for redemption at 105 and interest on or before December 15, 1914, at the Central Trust Company, of Illinois, all its $500,000 general-mortgage six-per-cent bonds.

The sale of $1,100,000 first-mortgage five-per-cent bonds of the Mesaba Railway Company by a syndicate headed by Tucker, Anthony & Company, New York City, to bankers, marks the first anniversary of the completion of construction of the road, which is now in full operation.

Authority has been granted the West End Street Railway Company by the Massachusetts Public Service Commission to issue $600,000 30-year bonds and 5,600 additional shares of common stock. The proceeds of this issue will be used to reimburse the Boston Elevated Railway Company for improvements made in accordance with terms of lease.

Harris, Forbes & Company and N. W. Halsey & Company, New York City, have jointly purchased $2,000,000 additional Pacific Gas & Electric Company five-per-cent notes, being the remainder of an authorized issue of $7,000,000. Notes are dated March 25, 1914, and due March 25, 1915, callable at any time at 100½ and interest. The $7,000,000 five-per-cent notes, in addition to being a general obligation of the company, are secured by deposit of $5,000,000 general and refunding-mortgage five-per-cent bonds and $5,000,000 general-lien six-per-cent bonds.

The sale of a $5,000,000 issue of one-year five-per-cent gold notes of the Portland Railway, Light & Power Company has been announced by E. W. Clark & Company of Philadelphia. The notes are dated May 1, 1914, and are due May 1, 1915. They were sold at 99.5 and interest to yield about 5.5 per cent and are secured by deposit of the entire issue of $5,000,000 of the first-mortgage sinking-fund thirty-year gold bonds of the Mount Hood Railway & Power Company, due in 1937; also of the entire capital stock (excepting only director's shares) of the Mount Hood Company.

Six subsidiary organizations of the American Telephone & Telegraph Company have arranged to sell to New York bankers $30,000,000 two-year five-per-cent notes, all having the indorsement of the parent concern. The notes were apportioned in this way: The Iowa Telephone Company, $2,500,000; the Cumberland Telephone & Telegraph Company, $6,000,000; the Nebraska Telephone Company, $4,000,000; the Missouri & Kansas Telephone Company, $7,500,000; the Northwestern Telephone Exchange Company, $7,500,000, and the Cleveland Telephone Company, $2,500,000. The sale of these securities is in line with the policy announced by President Vail at the annual meeting of the American Telephone & Telegraph Company of raising funds this year and next on direct borrowing by the constitutent concerns. A part of the proceeds, it is understood, will go into the American Company's treasury to liquidate loans previously made to the minor organizations.

Dividends.

	Term.	Rate.	Payable.
Bangor Ry. & Elec. com.	Q	0.5	May 1
Cape Breton Elec. com.	S-A	$3.	May 1
Cape Breton Elec. pf.	S-A	$3.	May 1
Common'th Pr. & St. com.	Q	1.	May 1
Common'th Pr. & St. pf.	Q	1.5	May 1
Conn. Ry. & Ltg. com.	Q	1.	May 15
Conn. Ry. & Ltg. pf.	Q	1.	May 15
Edison, Boston	Q	3.	May 1
Keystone Tel. pf.	S-A	3.	May 1
Lewiston, Augusta & Waterville pf.	Q	1.5	May 1
Mexican Tel. pf.	S-A	2.5	May 1
Pub. Service Invest. pf.	Q	$1.50	May 1
Rys. Co. Gen.	Q	1.	May 1
West Penn Rys. pf.	Q	1.25	May 1
Western Union	Q	1.	Apr. 15
J. G. White pf.	Q	1.5	May 1
Am. Gas & Elec. pf.	Q	1.5	May 1

Reports of Earnings.

SOUTHWESTERN POWER & LIGHT.

Combined earnings of subsidiaries of Southwestern Power & Light Company for February, 1914, and the 12 months ended February 28 are:

	1914.	1913.
February gross	$ 216,317	$ 175,680
Net after taxes	98,949	76,628
Twelve months' gross	2,344,500	1,994,139
Net after taxes	1,068,654	873,717

INTERSTATE ELECTRIC CORPORATION.

	1914	1913.
January gross	$ 20,650	$ 16,335
Net	8,524	7,591
Twelve months' gross	216,702	194,797
Net	102,436	93,729

PHILADELPHIA ELECTRIC.

The annual report of the Philadelphia Electric Company for the year ended December 31, 1913, compares as follows:

	1913.	1912.
Gross	$7,815,615	$7,051,497
Surplus after charges	1,928,243	1,666,189
Dividends	1,180,815	974,668
Surplus	747,427	691,520
Previous surplus	1,818,913	1,127,393
Stock dividends	1,499,265	.....
Total surplus	1,067,076	1,818,913

CHICAGO RAILWAYS COMPANY.

The Chicago Railways Company has issued its annual report for the year ended January 31, 1914. The income statement (joint account with the city of Chicago) compares as follows:

	1914.	1913.
Total earnings	$19,674,715	$18,076,777
Expenses and taxes	12,371,804	11,728,502
Balance	7,302,912	6,348,275
Five per cent on valuation	3,928,580	3,778,449
Net income	3,374,332	2,569,826
City proportion, 55%	1,855,882	1,413,404
Co.'s proportion, 45%	1,518,449	1,156,422

The non-partnership account compares as follows:

	1914.	1913.
*Gross income	$5,877,241	$5,149,139
Interest	4,472,437	4,140,569
Miscellaneous	1,121	.....
Sinking fund	250,000	250,000
Corporation expenses and adjustment	157,297	120,574
Total debentures	4,880,854	4,674,063
Net income	996,387	475,076

*Consists of 5% interest allowed on investment, Chicago Railway's share of net income (45%), and miscellaneous interest.

TEXAS POWER & LIGHT.

	1914.	1913.
February gross	$ 122,620	$ 92,038
Net after taxes	43,562	37,437
Surplus after charges	18,358	25,335
Twelve months' gross	1,246,332	1,034,492
Net after taxes	445,886	421,842
Surplus after charges	207,232	302,350
Balance after preferred dividends	96,982	230,425

FORT WORTH POWER & LIGHT.

	1914.	1913.
February gross	$ 64,605	$ 48,099
Net after taxes	36,430	27,941
Surplus after charges	26,223	23,466
Twelve months' gross	708,009	534,860
Net after taxes	420,171	267,803
Surplus after charges	332,794	204,373
Balance after preferred dividends	275,053	160,973

AUGUSTA RAILWAY & ELECTRIC CORPORATION.

Augusta Railway & Electric Corporation reports for year ended December 31, 1913, as follows:

	1913	1912
Gross earnings	$725,073	$662,591
Net after taxes	321,988	293,152
Surplus after charges	116,818	99,942
Balance after preferred dividends	26,818	9,942

DAYTON POWER & LIGHT COMPANY.

	1914	1913
March gross	$ 77,677	$ 37,523
Net earnings	16,725	*6,477
Surplus after preferred dividends	7,616	*14,914
Three months' gross	246,242	181,730
Net earnings	104,103	88,120
Surplus	29,021	13,932

*Deficit. Small earnings for March, 1913, were due to flood.

VIRGINIA RAILWAY & POWER.

	1914	1913
March gross	$ 415,399	$ 396,443
Net	210,278	197,019
Surplus	81,332	78,002
Nine months' gross	3,863,509	3,629,161
Net	1,932,532	1,815,241
Surplus	788,061	762,507

AMERICAN RAILWAYS COMPANY.

	1914	1913
March gross	$ 415,279	$ 399,796
Seven months' gross	4,136,488	3,854,742

AMERICAN POWER & LIGHT.

Combined gross and net earnings of operating subsidiaries of the American Power & Light Companw for February 1914 and the 12 months ended February 28 show as follows:

	1914	1913
February gross	$ 546,745	$ 486,308
Net after taxes	251,172	214,882
12 months' gross	5,992,965	5,404,321
Net after taxes	2,756,597	2,404,482

KENTUCKY SECURITIES CORPORATION.

Combined earnings of the Kentucky Traction & Terminal Company and the Lexington Utilities Company, operating subsidiaries of the Kentucky Securities Corporation for the eight months ended February 28, 1914, compare as follows:

	1914	1913
Gross earnings	$518,104	$495,698
Net earnings	266,851	237,904
Surplus after charges	103,439	89,566

PUBLIC SERVICE CORPORATION OF NEW JERSEY.

The gross earnings and income of the properties of the Public Service Corporation of New Jersey and subsidiary companies, for the past ten years, follow:

	Electric Properties.	Gas Properties.	Railway Properties.
1913	$8,545,845	$10,222,668	$16,201,932
1912	7,582,374	9,809,670	15,262,426
1911	6,689,731	8,985,688	14,450,088
1910	5,872,237	8,491,882	13,290,431
1909	5,117,728	7,870,878	12,114,412
1908	4,584,682	7,349,930	11,086,253
1907	4,647,219	7,251,480	10,705,392
1906	4,161,917	6,526,316	10,086,933
1905	3,721,631	6,059,442	9,488,358
1904	3,502,811	5,378,442	8,415,278

DETROIT EDISON COMPANY.

	1914	1913
March gross	$ 546,741	$ 463,137
Net	231,733	202,598
Surplus after depreciation and reserve	121,794	102,974
Three months' gross	1,703,402	1,431,128
Net	758,922	658,263
Surplus after depreciation and reserve	429,804	346,997

PORTLAND RAILWAY, LIGHT & POWER.

	1914	1913
February gross	$ 538,236	$ 530,071
Net after taxes	278,247	282,714
Surplus after charges	103,367	130,205
12 months' gross	6,760,919	6,675,837
Net after taxes	3,442,900	3,371,359
Surplus after charges	*1,391,666	1,580,321

*Equivalent to 5.9 per cent on capital stock.

CUMBERLAND COUNTY POWER & LIGHT.

	1914	1913
February gross	$ 168,062	$ 157,324
Net after taxes	53,606	62,925
Surplus after charges	*9,859	6,211
12 months' gross	2,377,457	2,161,772
Net after taxes	1,026,401	947,479
Surplus after charges	298,534	290,103

*Deficit.

GRAND RAPIDS RAILWAY.

	1914	1913
February gross	$ 96,747	$ 93,550
Net after taxes	34,109	37,002
Surplus after charges	20,447	22,181
12 months' gross	1,302,621	1,247,860
Net after taxes	487,713	534,576
Surplus after charges	323,361	359,311
Balance after preferred dividends	248,361	284,311

AMERICAN TELEPHONE & TELEGRAPH.

The American Telephone & Telegraph Company and associated holding and operating companies in the United States, not including connected independent or sub-licensee companies, report for the two months ended February 28, 1914, all duplications, including interest, dividends and other payments to American Telephone & Telegraph Company by associated holding and operating companies, are excluded), compared as follows:

	1914	1913
Gross earnings	$36,476,473	$34,425,557
Operating expenses, tax mt. and depreciation	26,669,337	24,623,295
Net earnings	9,807,133	9,802,062
Interest	2,984,156	2,749,241
Balance	6,822,977	7,052,821
Divident est. for two months	5,065,988	5,035,527
Surplus	1,756,989	2,017,294

The American Telephone & Telegraph Company reports or the three months ended March 31, 1913, compared as follows:

	1914	1913
Dividends	$6,295,408	$6,425,254
Interest and other revenue	3,634,392	3,031,635
Tel. tr. net	1,496,654	1,564,183
Other sources	137,547	195,170
Total	11,564,004	11,216,242
Expenses	1,330,572	1,218,503
Net earnings	10,233,431	9,997,739
Interest	2,048,669	1,811,630
Balance	8,184,761	8,186,109
Dividends	6,892,549	6,781,606
Balance	1,292,212	1,404,503

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	April 20	April 13
American Tel. & Tel. (New York)	120½	120
Commonwealth Edison (Chicago)	135	137
Edison Electric Illuminating (Boston)	250	255
Electric Storage Battery common (Philadelphia)	50¼	52
Electric Storage Battery preferred (Philadelphia)	50¼	52
General Electric (New York)	144	145
Kings County Electric (New York)	119	120
Manhattan Transit (New York)	1	1
Massachusetts Electric common (Boston)	10	11
Massachusetts Electric preferred (Boston)	59½	61
National Carbon common (Chicago)	108½	109½
National Carbon preferred (Chicago)	118½	119
New England Telephone (Boston)	135	135
Philadelphia Electric (Philadelphia)	25½	27
Postal Telegraph and Cables common (New York)	81	82
Postal Telegraph and Cables preferred (New York)	69	69
Western Union (New York)	61¼	62¼
Westinghouse common (New York)	72¼	73¼
Westinghouse preferred (New York)	117½	117

PERSONAL MENTION.

MR. S. B. WAY, vice-president of the Milwaukee Electric Railway & Light Company, has been elected vice-president and general manager of this company and also of the Milwaukee Traction, Light & Heating Company.

MR. THOMAS A. EDISON, together with his family, all of whom have been spending the past six weeks at their winter home in Fort Myers, Fla., have returned to Glenmont, Llewellyn Park, West Orange, N. J. Mr. Edison expressed himself to a friend that "a vacation is such a lazy thing a fellow has to put on weight whether he wants to or not."

MR. W. R. HURROW, of the Kansas Gas & Electric Company, of Independence, Kans., is a member of the Booster Clubs of Southeastern Kansas, which are on a 6,000-mile trip to New York and other Eastern cities. Nine counties of Kansas were represented on the special train of eleven cars, which left Independence on April 15 for the East, carrying Kansas products of all descriptions.

MR. A. H. R. JACKSON, manager of the Jefferson City (Mo.) Light, Heat & Power Company, has been made general manager of the Oskaloosa (Iowa) Traction & Light Company, which is controlled by the McKinley interests. The appointment is effective May 1. The change is in the nature of a promotion for Mr. Jackson, who has been at Jefferson City for several years. His successor has not been selected.

MR. J. W. RICHARDSON, superintendent of the Kansas City & Western Electric Railway, has recovered sufficiently from a recent operation to allow his removal from St. Margaret's hospital in Kansas City, Kans. Mr. Richardson, who is 45 years old, has been prominent in electric railway circles for the past quarter of a century, being a superintendent of the Metropolitan Street Railway Company, of Kansas City, before joining the interurban 12 years ago.

GEN. GEORGE H. HARRIES has been re-elected to the presidency of the Louisville (Ky.) Gas & Electric Company at the annual stockholders' meeting; MR. H. M. BYLLESBY has been chosen chairman of the Board, and MR. DONALD McDONALD, vice-president and general manager. MESSRS. JAMES B. BROWN, M. A. MORRISON, and F. C. GORDON have been appointed vice-presidents, and MR. T. B. WILSON, secretary-treasurer of the company.

MR. THOMAS SIDLO has been appointed by Mayor Newton D. Baker, of Cleveland, O., as head of the Public Service Department. The construction of a new $2,000,000 lighting plant will be one of the many problems which Mr. Sidlo will have to handle. Although but 26 years of age, Mr. Sidlo has been assistant street railway commissioner of his city since 1912. Shortly after this appointment he was made commissioner of franchises and then commissioner of information.

MR. CHARLES F. BROOKER, president of American Brass Company, was the guest of honor at a dinner at Sherry's, New York City, on April 15, on the occasion of the fiftieth anniversary of his entrance into the brass and copper business. The dinner was given by about 150 men prominent in finance and industry, with the copper trade particularly well represented. Mr. John D. Ryan, of the Amalgamated Copper Company, was toastmaster, and among the speakers were Col. T. L. Livermore, vice-president of Calumet & Hecla; Mr. C. A. Coffin, of the General Electric Company; Dr. William H. Nichols, of the Nichols Copper Company; ex-Senator William A. Clark; Mr. Howard Elliott; Mr. Charles M. MacNeil, president of the Utah Copper Company; Col. R. M. Thompson, of the International Nickel Company; Mr. Melville E. Stone, of the Associated Press, and Mr. B. Hochschild, of the American Metal Company.

DR. LEO. H. BAEKELAND, the inventor of Velox paper and of Bakelite, who made the Townsend cell an effective piece of apparatus in the manufacture of bleaching liquor, will be the first lecturer in the Chandler Foundation, on the afternoon of May 29, at Columbia University, during the celebration of the fiftieth anniversary of the founding of the School of Mines. Dr. Baekeland has an extraordinarily wide knowledge of the relation of chemistry to the industries, and is peculiarly fitted to introduce this series of lectures.

MR. W. A. BLONCK, of the Chicago engineering company of that name, spoke on "Boiler-Room Economy" before the Kansas City (Mo.) Electric Club, at the Coates House, on April 14. About 70 members of the club, which is winding up the season's work, attended. A dinner preceded the address. Among other things, Mr. Blonck asserted that there is no excuse for smoke of any great proportions emanating from boiler rooms. Most of the smoke which does issue from chimneys of such plants is caused by improper arrangement of the combustion chambers, or boilers he asserted. Mr. Blonck, prior to forming the company which bears his name, was chief master mechanic of the Chicago, Milwaukee & St. Paul Railway. The Kansas City Electric Club, comprised of all who are interested in electricity in any form, will conclude its season's work in May. Meetings will not be resumed until next fall because of hot weather. The club has been meeting semi-monthly.

OBITUARY.

MR. ORLANDO B. ROBBINS, a well known electrical contractor of Pittsburgh, Pa., died recently at his home in that city. He was employed at the city filtration plant. He is survived by his wife, one brother, and four sisters.

MR. DAVID ROBISON, JR., builder of the first electric railroad in Toledo, O., died in that city on April 15, at the age of 85. Mr. Robison was also chiefly responsible for the building of the Terminal Belt, a steam railroad encircling the city for a distance of 30 miles.

MR. CHARLES D. HEWITT, a Philadelphia electrical contractor, died suddenly on April 13, at his home in Burlington, N. J., at the age of 74 years, following an attack of apoplexy. He was famous as a big game hunter and widely known among sportsmen of the Eastern States.

MR. D. H. LOUDERBACK, a pioneer investor in and developer of telephone and telegraph and other public utilities, died at his home in Chicago, suddenly, on April 9. Mr. Louderback was a leading figure in Chicago traction affairs some time ago, but more recently was heavily interested in local real estate.

MR. ALFRED NOBLE, chief engineer of the Pennsylvania Tunnel and Terminal Railway Company and a former president of the American Society of Civil Engineers, died on April 19 at the age of 70 years. Mr. Noble was born in Michigan in 1844, and served for three years in the Army of the Potomac. He receive the degree of civil engineer in 1870, and for the next 12 years was in charge of improvements in the St. Mary's Falls Canal and St. Mary's River. From 1883 to 1886 he was general assistant engineer of the Northern Pacific Railroad, and for some years after that was in charge of the construction of railroad bridges in various parts of the country. He was a member of the Nicaragua Canal Board in 1895, of the United States Board of Engineers on Deep Waterways in 1899 and 1900, of the Isthmian Canal Commission from 1899 to 1903, and of the Board of Consulting Engineers of the Panama Canal in 1905. In May, 1912, Mr. Noble received the Elliott Cresson medal from Franklin Institute at Philadelphia in recognition of his work.

NEW PUBLICATION.

TERRESTRIAL MAGNETISM.—The United States Coast and Geodetic Survey has published the results of magnetic observations made at Sitka, Alaska, in 1911 and 1912 by Daniel L. Hazard. A separate bulletin contains a discussion of all the magnetic work of the department from July, 1911, to December, 1912, by R. L. Faris.

DATES AHEAD.

Iowa Electrical Association. Cedar Rapids, Iowa, April 23-24. Secretary, H. B. Maynard, Waterloo, Iowa.

Electrical Supply Jobbers' Association. May meeting, Chalfonte Hotel, Atlantic City, N. J., May 12-14. General secretary, Franklyn Overbagh, 411 South Clinton Street, Chicago, Ill.

Association of Railway Telegraph Superintendents. Annual meeting, New Orleans, La., May 19-22. Secretary, P. W. Drew, 112 West Adams Street, Chicago.

Southwestern Electrical and Gas Association. Annual meeting, Galveston, Tex., May 20-23. Secretary, H. S. Cooper, Dallas, Tex.

Cleveland Electrical Exposition, May 20-30. Manager, William G. Rose, Wigmore Coliseum, Cleveland, O.

Missouri Electric, Gas, Street Railway and Waterworks Association. Annual convention, on board steamer *Quincy* en route from St. Louis to Keokuk, Iowa, and return, May 21-23. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

National District Heating Association. Sixth annual convention, Rochester, N. Y., May 26-28. Secretary, D. L. Gaskill. Greenville Electric Light & Power Company, Greenville, O.

Indiana State Electrical Contractors' Association. Convention, Indianapolis, Ind., May 28-29.

National Electric Light Association. Annual convention, Bellevue-Stratford Hotel, Philadelphia, Pa., June 1-5. General secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

Oregon Electrical Contractors' Association. Annual meeting, Portland, Ore., June 8-9. Secretary, J. C. Green, Portland, Ore.

Michigan Section, National Electric Light Association. Annual convention cruise leaving Detroit, June 17, for the Thousand Islands and intermediate points, returning June 20. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

With the Electrical Manufacturers

Ward Motor Vehicle Company, New York City, has issued a circular describing Ward electric vehicles.

Transportation Utilities Company, 30 Church street, New York City, announces that it has acquired the entire business of the General Railway Supply Company.

Wightman & Richards, New York, City, counsellors and consulting engineers in technical advertising, announce the removal of their offices from 29 Broadway to 50 Union Square, New York City.

C. & C. Electric & Manufacturing Company, Garwood, N. J., announces that its Cleveland agent, Charles S. Powell, has removed his office to more commodious quarters in the Illuminating Building, Cleveland, O.

The Strong-Smith Manufacturing Company, 24-26 First Street, South, Minneapolis, announces that it has purchased the factory and business of the Zimmer Vacuum Renovator Company and will continue the business.

Peerless Insulated Wire & Cable Co., 18 Broadway, New York City, has issued a booklet on Peerless weatherproof insulation. The first few pages of this booklet are devoted to a description of the manufacturing process, while the last few pages give the results of tests performed by the Electrical Testing Laboratories, of New York City.

Allen-Bradley Company, Milwaukee, Wis., has issued bulletin B-53 which deals with type G inclosed switches for small alternating-current motors that require no starting resistance. These are made in three forms varying in their equipment of protective devices. They are of simple and rugged construction and made for motors ranging from one-fourth to ten horsepower.

Line Material Company, South Milwaukee, Wis., announces that L. E. Hendee, vice-president of the company, has taken active charge of the sales department. W. D. Kyle, general manager of the company and formerly in charge of the sales department, will devote more of his time to investigating and developing the company's line of street-lighting fixtures and line-construction material.

The Richmond Electric Works, Richmond, Va., manufacturer of alternating-current motors, which for a number of years has been represented in the Philadelphia territory by E. B. Day, announces that it has discontinued the agency with Mr. Day and has opened its own office at 1418 Walnut Street, Philadelphia, Pa. The already large stock of Richmond motors carried in that city, will be materially increased to take care of the growing demand.

Standard Underground Cable Company, Pittsburgh, Pa., has issued bulletins Nos. 200-1 and 400-1. The former is devoted to the specifications for standard Colonial-Copper-Clad wire. These specifications conform with those recommended by the American Society for Testing Materials for hard-drawn copper wire. Bulletin No. 400-1 describes weatherproof insulated wires and cables, solid and stranded, double and triple braid. Numerous tables giving size of conductors, prices, weights and shipping data are given.

The Brown Instrument Company, Philadelphia, Pa., has issued catalog No. 9 describing in detail pyrometers for various purposes. This 60-page catalog first considers the various applications for pyrometers, then their construction and finally the different types. A number of illustrations show the various methods of installing thermo-electric couples. For high temperatures, the radiation pyrometer is recommended. Notes are given on wiring and adjustments. An appendix giving 100 letters from satisfied users accompanies the bulletin.

The L. K. Deal Lumber Company, Des Moines, Iowa, was incorporated January 1, 1914, with a capital stock of $25,000 to engage in the cedar-pole business. L. K. Deal is the president and W. C. Sharp is vice-president and secretary. The company occupies large offices on the fifth floor of the Clapp building, and is well prepared to fill the needs of cedar-pole users. The company has cut a normal stock of northern poles from its own lands in northern Minnesota. This stock is now being shipped to the yards. The company also has a western connection in Spokane to look after its western (red-cedar) stock. The Deal Company is prepared to make quick shipments, in fact, it claims to be able to ship on 48 hours' notice. Mr. Deal has been in the cedar business a number of years. Mr. Sharp, who joined the company the first of the year, was formerly manager of the Helena Light & Railway Company, Helena, Mont. His long experience in railway and lighting construction will undoubtedly enable him to be of material assistance to users of poles.

Fairbanks, Morse & Company, Chicago, has recently issued bulletin No. 27 on direct-current type-CP motors and generators. This eight-page illustrated bulletin describes these commutating-pole motors in detail. Bulletin No. 29 is devoted to a description of direct-current type-TRC motors and generators. These motors are of the commutating-pole type and are suitable for driving machine tools and for installing on floor, wall or ceiling. The company has also issued bulletin No. 210 describing internal-starter motors, types KBV and KBH for two and three-phase circuits. Type-KBV motors are adapted to operate on electric-light circuits where the starting of squirrel-cage motors would impair the lighting service. The other type is designed for intermittent service. Torque-time and current-time curves for these motors are given as well as illustrations of the various parts of the motors. A reprint of the bulletin on alternating-current type-B constant-speed induction motors has also been issued. This bulletin, No. 202B, is well illustrated by views of installations, the motors and their parts, and several types of motor starters.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports a number of important orders recently received from the metal-mining industry, among which were the following: United Verde Copper Company, Jerome, Ariz., one 24-panel switchboard for the new smelter at Clarkdale. El Paso (Tex.) Smelting Company, two 55-horsepower direct-current back-geared motors for operating converters. Magma Copper Company, Superior, Ariz., nine squirrel-cage induction motors totaling 267 horsepower and transformers aggregating 90 kilovolt-amperes for operating copper concentrating mill. Anaconda (Mont.) Copper Mining Company, six 150-kilovolt-ampere transformers for the Washoe smelter; also 14 motors totaling 290 horsepower for driving mine ventilating fans. National Copper Mining Company, Wallace, Idaho, one four-ton barsteel locomotive. Utah Copper Company, Magna, Utah, four 15-horsepower slow-speed vertical motors for direct connection to agitators used in oil flotation process; also two 50-kilowatt motor-generator sets with switchboards and three 100-kilowatt transformers. Kennecott (Alaska) Mines Company, one 50-horsepower back-geared alterating-current motor and three 25-kilowatt transformers. Alaska Gastineau Mining Company, Juneau, Alaska, two 18-ton barsteel locomotives for underground and surface work. Alaska Juneau Mining Company, Juneau, Alaska, one 5.5-ton storage-battery locomotive. Mason Valley Mines Company, Thompson, Nevada, two 15-horsepower motors with brakes, controllers and resistors, for use in ladle tilting in copper smelter. Tonopah Belmont Company, Tonopah, Nevada, one 75-horsepower motor used for driving an Aldrich pump. Brunswick Consolidated Gold Mining Company, Grass Valley, Cal., three 100-kilowatt transformers.

General Electric Company, Schenectady, N. Y., announces that among its recent orders for electrical machinery were the following: Sierras Construction Company, Imperial Valley, Cal., a 2,000-kilowatt synchronous condenser, three 1,250 and nine 300-kilowatt transformers, switchboard and accessories. Montana Power Company, Butte, Mont., a 3,750-kilowatt alternating-current generator. Pittsford Power Company, Rutland, Vt., a 1,250-kilowatt alternating-current generator, three 400-kilowatt water-cooled transformers and a switchboard. Towaliga Falls Power Company, Griffin, Ga., a 1,600-kilowatt alternating-current generator and switchboard. Pennsylvania

Steel Company, Steelton, Pa., a 450-kilowatt regulating set, a 600-horsepower induction motor and switchboard. Detroit Seamless Steel Tube Company, Detroit, Mich., two 300-horsepower induction motors with control equipments and switchboard. Indiana Steel Company, Gary, Ind., 27 15-horsepower induction motors. Worcester Pressed Steel Company, Worcester, Mass., three 300-kilowatt transformers, a 500-horsepower induction motor with control equipment and switchboard. American Iron & Steel Manufacturing Company, Lebanon, Pa., a 4,000-kilowatt two-unit motor-generator with combined exciter and blower set. John Wood Manufacturing Company, Conshohocken, Pa., two 200-kilowatt rotary converters, four 110-kilowatt transformers and a switchboard. Jeanesville Iron Works Company, Hazelton, Pa., three 200-horsepower induction motors with compensators. American Cement Plaster Company, Fort Dodge, Iowa, 34 motors ranging from 7.5 to 75 horsepower, switches and accessories. American Bottle Company, Streator, Ill., 40 motors ranging from very small sizes up to 125 horsepower, switchboard and accessories. California Portland Cement Company, Colton, Cal., 35 motors ranging from 10 to 50 horsepower, relay panels, switches, etc., and a 25-kilowatt motor-generator set. St. Lawrence River Power Company, Massens, N. Y., three 1,250, two 1,000, one 300, one 100 and two 50-horsepower induction motors, together with transformers, switchboards and other accessories. Riverside Portland Cement Company, Crestmore, Cal., nine motors ranging from 10 to 200-horsepower, transformers, switches, etc. Ottawa Silica Company, Ottawa, Ill., six motors ranging from 35 to 100 horsepower, a 50-kilowatt motor-generator set, switchboard, etc. Iowa Portland Cement Company, Des Moines, Iowa, a 160-kilowatt motor-generator set, a 165-horsepower induction motor, switchboard and accessories. State Phosphate Company, Alafia, Fla., a 400-horsepower induction motor. Western Rug Company, Duluth, Minn., 30 motors ranging from 1 to 35 horsepower, switches, etc. Power & Mining Machinery Company, Cudahy, Wis., 33 motors ranging up to 150 horsepower. Indiana Quarries Company, Bedford, Ind., 38 30-horsepower induction motors. Hanover Brick Company, Whipanny, N. J., 14 motors ranging from 3 to 75 horsepower, with compensators and accessories.

Record of Electrical Patents.

Issued by the United States Patent Office, April 14, 1914.

1,092,849. Rotor Construction for Indication Motors. J. D. Nies, assignor to Kimble Electric Co., Chicago, Ill. Has separate high and low-resistance windings, the latter being thrown in by centrifugal force.

1,092,878. Therapeutic Electric Apparatus. R. H. Wappler, assignor to D. T. Garrie, New York, N. Y. Strength of current varied by sliding motor-operated core.

1,092,880. Rheostat. H. J. Wiegand, assignor to The Cutler-Hammer Mfg. Co. Resistance elements staggered on opposite sides of contacts.

1,092,886. Rock-Drill. C. E. Youmans, Yonkers, N. Y. Includes electric ignition of driving engine.

1,092,891. Trolley Switch. A. Bevan, Providence, R. I. A trolley switch for electric signal system operated by trolley wheel.

1,092,918. Signal Device. David G. Knittel, assignor to American Fire Alarm Co., Pittsburgh, Pa. A multiple signal transmitter.

1,092,919. Signal Transmitter. D. G. Knittel and W. J. Davis, assignors to American Fire Alarm Co. A modification of 1,092,918.

1,092,952. Compression-Rheostat. P. J. Ray, Lakewood, O. A cam and spring-plunger arrangement.

1,092,957. Means for Reducing Reflection Losses in Phantom Circuits. T. Shaw, assignor to American Telephone & Telegraph Co. Includes use of transformers at junction of phantom and physical circuits.

1,092,966. Recording Flow-Meter. J. Wilkinson, assignor to General Electric Co. Has magnetic float and magnetic transmission of motion.

1,092,969. Automatic Electromagnetic Switch. Curtis Benton, San Francisco, Cal. A flasher having magnetically controlled contacts.

1,092,977. Printing-Controlled Electric Sign. M. Compos, Mobile, Ala. Operated by means of perforations on strip of insulating material.

1,092,982. Pneumatic Transmission System. E. D'Humy, assignor to The Western Union Telegraph Co. Pressure-controlled incandescent lamp denotes arrival of carrier.

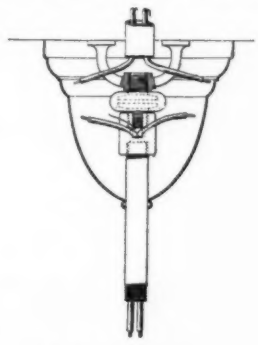
1,092,985. Appliance for Cleaning Tarnished Metals. H. M. Fetters, Laporte, Ind. Utilizes electrolytic action.

1,093,001. Telegraphy. I. Kitsee, assignor to American Telephone and Telegraph Co. Transmission system for telegraphic cables utilizing two transformers.

1,093,007. Hickey. C. D. Platt, Bridgeport, Conn. For an electric fixture. (See cut.)

1,093,009. Lamp Support. J. C. Ramsey, Jr., assignor to Herrick Aiken Co., Inc., Lawrence, Mass. A rotable electric-lamp fixture.

1,093,010. Method of and Means for Manufacturing Metal Pipe and Tubing.



1,093,007.—Hickey.

E. E. Ries, New York, N. Y. Seams electrically welded.

1,093,025. Trolley-Wheel Construction. W. H. Arnold, Stockton, Cal. Bearing pin has two spaced conical bearing shoulders.

1,093,034. Party-Line Telephone System. A. G. Cerda, assignor to Walter Mooers, Arlington, Mass. Has electrically actuated cut-out for severing connection with all branches except the one in use.

1,093,041. Party-Line Telephone System. C. J. Erickson, Chicago, Ill., assignor to First Trust and Savings Bank, Chicago, Ill. An automatic system.

1,093,045. Dynamo-Electric Machine. V. A. Fynn, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Magnetism of auxiliary poles is dependent on difference of voltage between main and auxiliary brushes.

1,093,051. Oil Switch. E. M. Hewlett and C. E. Eveleth, assignors to General Electric Co. Arc extinguished by displaced oil.

1,093,056. Rotary Explosive Engine or Motor. A. K. Landsmann and F. Dippon, St. Louis, Mo. Has electric ignition.

1,093,072. High-Frequency Discharge Apparatus. H. W. Perkin, assignor to High Frequency Ignition Coil Co., Los Angeles, Cal. Has coil of high inductance and condensers to prevent flow of high-tension current to discharge coil.

1,093,074. Electric Motor. E. S. Pillsbury, assignor to Century Electric Co. Centrifugal force changes rotor connections at predetermined speed.

1,093,083. Distribution System for Vapor Electric Devices. R. G. Standerwick, assignor to General Electric Co. Current-regulating device for mercury-arc lamp.

1,093,100. Multiple Key. C. E. Beach, assignor to G. O. Knapp, New York, N. Y. Has a number of current-supply contacts and circuit contacts.

1,093,113. Spark Plug. C. M. Conklin, Cincinnati, O. Has bifurcated electrode.

1,093,122. Lamp. C. E. Godley, assignor to Edmunds and Jones Mfg. Co., Detroit, Mich. A circumferential spring supports reflector.

1,093,126. Temperature Regulator. W. S. Hadaway, Jr., New York, N. Y. Heater is electrically controlled by pressure-operated contacts.

1,093,132. Call System. J. Hergesheimer, Glenside, Pa. An electromagnetic annunciator system.

1,093,137. Electromagnetic Controlling Device. H. J. Keating, Chicago, Ill. A solenoid-operated device having pneumatic damping means.

1,093,144. Portable Electric Lamp. W. J. Monaghan, assignor to Waterbury Mfg. Co., Waterbury, Conn. Spring makes contact with zinc casing of battery.

1,093,147. Electrical Controlling Mechanism. F. N. Reeves, assignor to Western Electric Co. An electromagnetically controlled system.

1,093,149. Driving Mechanism for Electrically-Propelled Vehicles. E. W. Schneider, New York, N. Y. Motors mounted in hubs of wheels.

1,093,164. Refillable Fuse-Cartridge. G. W. Appler, Lyons, N. Y. Has opening in tube for operating fuse-clamping means.

1,093,182. Arc-Electrode and Process for Making It. J. L. R. Hayden, assignor to General Electric Co. Consists of iron tube packed with solidified fusion of magnetite, rutile, chromite, and fluoride of potassium.

1,093,195. Electrical Water Heater. R. R. Lockhart, Winnipeg, Manitoba, Canada, assignor to himself, G. A. Glines, W. E. Wright, V. Williams, D. B. Sprague, and J. D. Sinclair. Heating element inside of heater. (See cut.)

1,093,197. Method of Welding Lamp-Filaments. G. F. Morrison, assignor to General Electric Co. Electromagnet deflects arc during welding process.

1,093,221. Case for Incandescent-Electric-Lamp Sockets. A. Weber, Sr., and J. Weber, assignors to Weber Electric Co., Schenectady, N. Y. Includes a sleeve and cap.

1,093,235. Trolley-Wire Feed-Tap Insulator. E. L. Alvord, assignor to The Johns-Pratt Co., Hartford, Conn. Has insulating bushing with flanges to prevent longitudinal movement.

1,093,236. Electrolytic-Cleaning Electrode. T. Appleby, Philadelphia, Pa. Zinc electrode separated from metallic tank by insulator supporting article to be cleaned.

1,093,237. Electric Heater. G. A. Arnold, assignor to Arnold Electric Co. Spiral heating element can be inserted in pipe through terminal openings.

1,093,240. Wireless-Telegraph Receiver. J. G. Balsillie, Melbourne, Victoria, Australia. Covers arrangement of circuits.

1,093,271. Electromagnetic Tachometer. N. M. Hopkins, assignor to The Electric Tachometer Co., Philadelphia, Pa. Has thermostatic temperature-compensating device.

1,093,281. Electric Welding Machine. N. Macneale, assignor to The Toledo Electric Welder Co., Cincinnati, O. Includes a horn having a laterally offset portion.

1,093,287. Electric Cap-Light. A. R. Neff, Los Angeles, Cal. Fits ordinary dry cell.

1,093,292. Apparatus for Producing Electric Signals. F. Rieber, Berkeley, Cal. A pneumatic telegraph key with pneumatic arc extinguishers.

1,093,318. Electrical Sparking Device. W. J. Cunningham, assignor of one half to F. G. Meyer, Toledo, O. A spark plug for an engine cylinder in which magnet assists in controlling contact points.

1,093,332. Securing Device for Electroliers and the Like. G. W. Jockers, assignor to E. H. Hopkins, Cleveland, O. Clamping device for fixture pipe. (See cut.)

1,093,367. Terminal for Electric-Light Fixtures. F. W. Wakefield, assignor to The F. W. Wakefield Brass Co., Vermilion, O. A combination of a plate and terminal member.

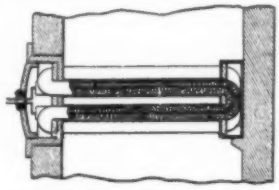
1,093,368. Vapor Electric Device. E. Weintraub and A. E. Hibschman, assignors to General Electric Co. Has outside conducting surfaces on tube near anodes.

1,093,378. Motor-Control System. L. E. Bogen, assignor to Allis-Chalmers Mfg. Co. Starting rheostat and load-balancing means for direct-connected motor of wound-rotor type.

1,093,382. Electric Furnace. J. W. Brown, assignor to National Carbon Co. Has channels and means for causing charge to move through these channels.

1,093,384. Rotary Electroplating Apparatus. C. J. Charlton, South Benfleet, England. Has revolving electrodes.

1,093,395. Automatic Fire-Alarm. E. A. Gehrke, Lincoln, Nebr. Has thermostat.



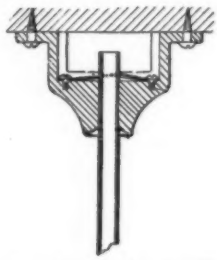
1,093,195.—Water Heater.

1,093,423. Spark-Plug. E. Holzworth, Alliance, O. Two electrodes pass through plug.

1,093,468. Separable Attachment-Plug. J. G. Peterson, assignor to Manhattan Electrical Supply Co., Jersey City, N. J. Has laterally disposed plugs.

1,093,477. Means for Protecting Electric Circuits from Excessively High Differences of Potential and Similar Disturbances. R. Rüdenberg, assignor to Siemens-Schuckert Werke, G. M. B. H., Berlin, Germany. Inductances are inserted in lines, and condensers and resistances between lines.

1,093,479. Insulator. J. A. Sandford, assignor to The R. Thomas and Sons Co., East Liverpool, O. A built-up petticoat insulator.



1,093,332.—Securing Device for Electroliers.

1,093,480. Insulator. J. A. Sandford, assignor to R. Thomas and Sons Co., East Liverpool, O. A modification of 1,093,479.

1,093,491. Static Electric Eradicator. A. Smith, assignor to Static Electro Eradicator, Inc., Syracuse, N. Y. Includes a series of projecting wires connected to ground.

1,093,494. Electric Furnace for Medium Temperatures Particularly for Melting Copper and its Alloys. E. Stassano, Turin, Italy, and N. Petinot, Niagara Falls, N. Y. Has cylindrical melting chamber and two electrodes.

1,093,507. Trolley-Wheel Guard. E. W. Warnick, Cuyahoga Falls, O. Plates serve to prevent displacement of trolley.

1,093,510. Electric Stove or Iron. G. Wenzelmann, Galesburg, Ill. Contains electric heating coil.

1,093,511. Coin or Check Controlled Apparatus. W. B. Wheeler, Washington, D. C. Has electric timing mechanism.

1,093,539. Machine for Covering Electric Conductors. E. H. Cook, assignor to International Wire Co. Includes means for covering and impregnating wires.

1,093,544. Internal-Combustion Engine. C. de Lukacsevics, assignor to G. W. Morgan, Jr., New York, N. Y. Includes electric ignition.

1,093,545. Starting Means for Vapor Electric Apparatus. J. T. H. Dempster, assignor to General Electric Co. A conducting filament formed of carbon having one end tipped with titanium carbide.

Patents Expired.

The following United States electrical patents expired April 20, 1914:

580,851. Magneto Telephone. L. E. Dye, Morris, Minn.

580,853. Telephone Switchboard. C. E. Egan, Chicago, Ill.

580,889. Armature for Dynamo-Electric Machines. A. L. Parcelle, Boston, Mass.

580,893. Elevator. C. R. Pratt, New York, N. Y.

580,894. Elevator Safety Device. C. R. Pratt.

580,927. Fire-Alarm System. C. E. Buell, North Plainfield, N. J.

580,929. Interlocking Switch for Theater Dimmers. G. L. Colgate, Westfield, N. J.

580,931. Electric Selling Device. A. Davidson, New York, N. Y.

580,957. Automatic Cutout. C. A. Rolfe, Chicago, Ill.

580,973. Switch and Signal Apparatus. C. A. Geissenhainer, Pittsburgh, Pa.

580,977. Sectional Armature for Dynamos and Electric Motors. G. L. Jeck, Nashville, Tenn.

580,987. Oscillating Interrupter. D. M. Moore, Newark, N. J.

580,988. Interrupter. D. M. Moore.

581,023. Section Insulator for Electric Railways. S. L. Foster, San Francisco, Cal.

581,044. Annunciator-Signal for Telephone Systems. W. F. Smith, San Francisco, Cal.

581,064. Junction-Box Coupling for Electric Wire Conduits. J. P. Coughlin, Worcester, Mass.

581,088. Electric-Wire Insulator. J. E. Sharpe, Oneida, N. Y.

581,089. Dynamo-Electric Machine. M. O. Southworth, Indianapolis, Ind.

581,091. Electromedical Apparatus. R. H. Wappler, New York, N. Y.

581,101. Magnet. G. G. Brown, Brooklyn, N. Y.

581,104. Construction of Batteries. E. N. Dickerson, New York, N. Y.

581,115. Elevator. C. A. Harkness, Providence, R. I.

581,129. Electric Light and Headgear for Surgical Use. L. W. Nevins, Chicago, Ill.

581,135. Telegraph Key. M. M. Porter, Malone, N. Y.

581,136. Electric Arc Lamp. W. L. Preece, Derby, England.

581,170. Electrical Resistance-Coil. J. Nebel, London, England.

581,204. Electric Pump. B. Heftye, Tuxpan, Mexico.

581,242. Erecting Aerial Electric Cables. F. S. Viele, Pittsburgh, Pa.

581,246. Combined Telephone and Electric-Lighting System. C. E. Buell, North Plainfield, N. J.